STUDY OF POST OPERATIVE OUTCOME OF VARICOSE VEIN SURGERY

Dissertation submitted in partial fulfillment of regulation for the award of

M.S. DEGREE

in

GENERAL SURGERY (BRANCH I)

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI

APRIL 2015

COIMBATORE MEDICAL COLLEGE HOSPITAL

CERTIFICATE

This is to certify that this dissertation titled **"STUDY OF POST OPERATIVE OUTCOME OF VARICOSE VEIN SURGERY"** submitted to the TamilNadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the requirement for the award of M.S Degree Branch - I (General Surgery) is a bonafide work done by **Dr. S. Veeranan**, post graduate student in General Surgery under my direct supervision and guidance during the period of September 2013 to August 2014.

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AIM ? To study the post operative outcome of patients who undergone varicose vein surgery – towards symptoms, signs of patients after a prescribed period. ? To evaluate quality of life of the patients after surgery ? To study the incidence of post operative complications and recurrence. ABSTRACT Varicose veins are dilated and tortuous veins, which affect a significant proportion of adults. They cause physical and emotional symptoms, and affect quality of life in sufferers. More than 5% of the population have varicose vein, and 1% have or had venous ulceration. Varicose vein causes
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DECLARATION

I solemnly declare that the dissertation titled "**STUDY OF POST OPERATIVE OUTCOME OF VARICOSE VEIN SURGERY**" at Coimbatore Medical College Hospital was done by me from September 2013 to August 2014 under the guidance and supervision of Professor Dr. D.N. RENGANATHAN, M.S. This dissertation is submitted to the Tamilnadu Dr. M.G.R. Medical University towards the partial fulfillment of the requirement for the award of M.S Degree in General Surgery (Branch I).

Place: Coimbatore

Date: **DR. S. VEERANAN**

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CONTENTS

ABBREVIATIONS

GSV	GREAT SAPHENOUS VEIN
SSV	SHORT SAPHENOUS VEIN
CVD	CHRONIC VENOUS DISEASE
CVI	CHRONIC VENOUS INSUFFICIENCY
DVT	DEEP VEIN THROMBOSIS
CVU	CHRONIC VENOUS ULCER
USG	ULTRASONOGRAPHY
IL-1	INTER LEUKIN -1
CEAP	CLINICAL ETIOLOGY ANATOMY PATHOLOGY
SFJ	SAPHENO FEMORAL JUNCTION
SPJ	SAPHENO POPLITEAL JUNCTION
PL	PERFORATOR LIGATION
SFJFL	SAPHENO FEMORAL JUNCTION FLUSH LIGATION
PV	PERFORATOR VEIN
EVLT	ENDOVENOUS LASER THERAPY
EVS	EDINBURG VENOUS STUDY
SEPS	SUBFACIAL ENDOSCOPIC PERFORATOR SURGERY
RFA	RADIO FREQUENCY ABLATION

LIST OF FIGURES

AIM

- To study the post operative outcome of patients who have undergone varicose vein surgery – towards symptoms, signs of patients after a prescribed period.
- To evaluate quality of life of the patients after surgery

ABSTRACT

Varicose veins are dilated and tortuous veins, which affect a significant proportion of adults. They cause physical and emotional symptoms, and affect quality of life in sufferers. More than 5% of the population have varicose vein, and 1% have or had venous ulceration. Varicose vein causes substantial morbidity, cosmetic, monetary loss and psychological effect.

OBJECTVE:

- To study the post operative outcome of patients who undergone varicose vein surgery-towards symptom, signs of patients after a prescribed period.
- To evaluate quality of life of patients undergone varicose vein surgery
- To evaluate incidence of post operative complications of varicose vein surgery and recurrence

METHOD:

The study carried out with the follow-up information relating to 53 patients who were undergone varicose vein surgery. The patients were followed in the post operative period for the expected complications. All the patients were subjected to duplex scan in the follow-up period ranging from 3 months to 1 year.

A questionnaire was prepared to collect precise information regarding the life style and symptomatic improvement of the patients. The post operative follow-up and questionnaire data was analysed.

RESULTS:

It is observed that, out of 53 patients, 6 patients (11.25%) had mild wound infection which did not require any additional treatment. There was no incidence of deep vein thrombosis, pulmonary embolism. No patients experienced neurological deficit or paraesthesia in the post operative period. No patients experienced bleeding from wound. After surgery 34 patients felt leg pain cured, 24 patients felt cosmetic improvement and 7 patients had ulcer completely cured. Overall quality of life was improved in 42 patients after surgery.

CONCLUSION:

Patients with complications of varicose vein combined with valvular incompetence underwent surgery like saphenofemoral junction flush ligation, with/ without stripping; with/without perforator ligation have had improvement in their cosmetic appearance ,cure in leg pain, leg ulcer cured, improvement in life style , improvement in ability to do work as well as recurrence of varicose vein was not seen. The study period was short, so the patients need long term follow-up to find out recurrence.

HISTORICAL ASPECTS

Galen in second century used silk ligature to tie off blood vessels and suggested varicose veins should be treated by incision, avulsion with use of hooks[1].

14th to 20th century:

In 14th century Maitre Henre de Mondeville successfully used bandage on limbs with ulceration to drive back evil humours.

In 16th century anatomy of venous system was presented in great details in work of Andeas Vesalius. Presence of venous valves was probably first mentioned by JB Canano in 1547.

Hieronymius Fabricius de Aquapendente wrote on surgical treatment of varicose vein in his book Opera Chirurgica published in 1593.

William Harvey described blood circulation. In 1810, Ferriar described a patient with phlegmasia alba dolens .

Davis in 1822 recognised relation between venous thrombosis and child birth. Brodie in 1846 described his test of venous valvular incompetence and used compression bandages to treat venous ulcer.

Unna developed unna boot in 1854 –an elastic plaster dressing with glycerine gelatine mixtue. Virchow described his revolutionary discovery of three main causes of Deep Vein Thrombosis [DVT] –changes in

venous wall, stasis of venous blood and changes in blood coagulationin his book Die cellular pathologie.

In 1864 Pravez initiated sclerotherapy and injected perchloride of iron to sclerose varicose veins using hypodermic needles.

20th century land marks:

Proximal ligation of great saphenous vein was described by Trendelenburg in 1891. Kellar described internal stripper in 1905. Charles H Mayo used an external ringed stripper in 1906. Bobcock's contribution was development of flexible internal saphenous stripper.

Reconstructive surgery – Eck was the 1st to perform anastamosis between portal vein and inferior vena cava. John Homan in 1917 introduced the term venous stasis and post thrombotic syndrome.

First attempt at phlebography by injection of strontium bromide were made by Berberick & Hirsch in1923. Fibrinolytic effect of streptococcus was 1st described in 1993 by Tillet and Garner. Bauer showed beneficial effect of heparin in DVT in1941.

Linton described subfascial ligation of incompetent communicating vein in 1938. Franck Cockett suggested the term blow out syndrome.

COCKETT's book co-written by Doddwas, is the 1st standard text book of treatment of venous disease.

EPIDEMIOLOGY

Varicose vein is a common surgical problem present in 10% of population. Incidence is less in India compared to developed countries. Prevalence is 20% to 25% in female, 10% to 15% in men in western countries (Callam M J 1994 Epidemiology of varicose vein, Br. J. Surg, 81 167-173)

Edinburg venous study (EVS) published in 1998 shows prevalence of varicose vein 39.7% in men, 32.2% in women. Prevalence of varicose vein increases with age in published studies. Prevalence is 11.5% in 18 to 25 years of age group, 55.7% in 55-64 years age group. EVS 2004 shows prevalence 50.3% in men and 32% in female.

ANATOMY

NORMAL VENOUS HISTOLOGY AND FUNCTION[5]

HISTOLOGY OF VEIN

The vein wall contains three concentric layers[6]

- Tunica intima (inner layer)
- Tunica media (middle layer)
- Tunica adventitia (outer layer)

INNER INTIMAL LAYER

Inner layer is known as intima. Its main component endothelium lines entire vascular tree including heart. This layer is absent in venules. An internal elastic lamina is present in the sub endothelial layer of the larger veins. Special endothelial cells produce plasminogen activator.

MIDDLE LAYER

The middle media is composed of elastin connective tissue and smooth muscle cells. It varies in size between veins of different calibre. It is thin in venules. This layer is thickest in arteries.

OUTER LAYER

The outer layer is known as adventitia, it consists of collagen fibres, largely longitudinal. It contains vasa vasorium and sympathetic nerve fibres.

VENOUS WALL FUNCTION

Large venules and veins form an extensive but variable large volume low pressure system of vessels conveying blood back to the heart. The outer adventitial layer of venous wall contains adrenergic fibres mainly in cutaneous veins. Venous wall tone can be altered by central sympathetic discharge and brainstem thermoregulatory centres and also other stimuli like change in body temperature change in blood volume and pain. Vein histology varies depending on calibre of vein. Smallest veins are venules size range from 0.1mm to 1mm. The large veins present in lower limb have less smooth muscle.

Veins are thin walled, distensible and collapsible structures. The two important functions of vein are transportation of blood back to heart and storage of blood. Blood flow in veins is depends on following factors such as gravitation, competent valves, volume of blood, cardio repiratory cycles and muscle pump. Any alteration in equilibrium of these factors may leads to pathology of vein.

Blood flow in veins is unidirectional and this is maintained by presence of valves in the wall of veins. The valves are more in distal part of vein and become progressively few in proximal part of vein.

Venous valves have two leaflets. They allow unidirectional flow of blood. The venous valves become closed if blood flow is craniocaudal direction, at a speed of atleast 30 cms/s^2. Common iliac veins, inferior

vena cava, portal vein and venous sinuses in soleus and gastracnemius are valve less.

VEINS OF LOWER LIMB[7]

There are three systems of veins, which are

- Superficial venous system
- Deep venous system
- Communicating system
    - Perforator
    - Intersaphenous

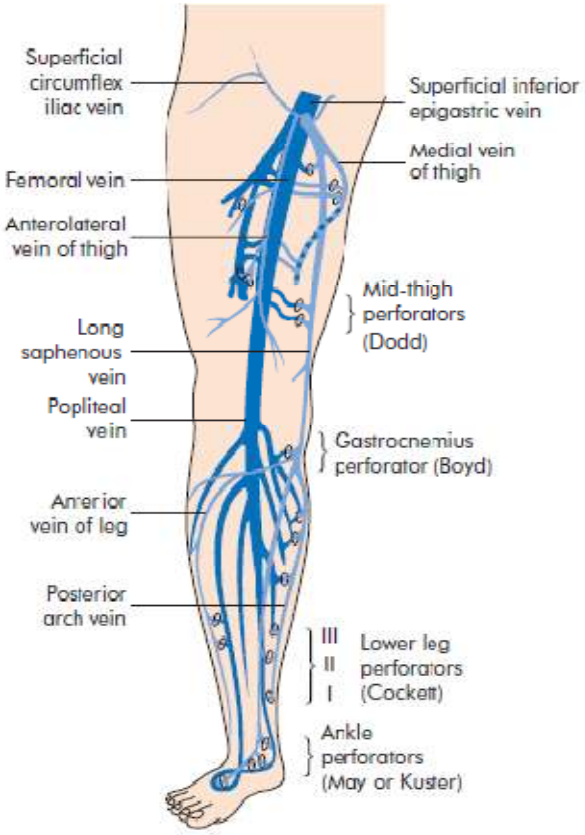


Figure 1: Anatomy of Lower Limb Venous System

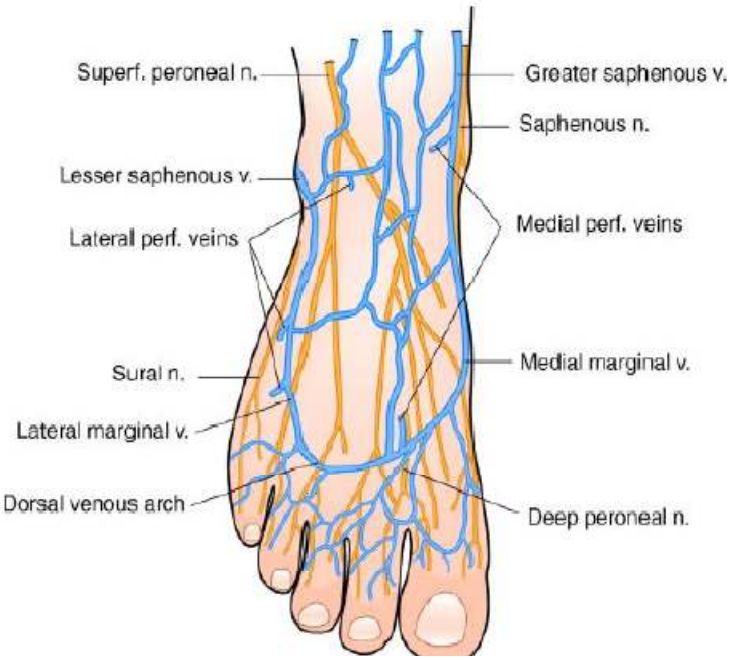


Figure 2: Venous Drainage of Foot

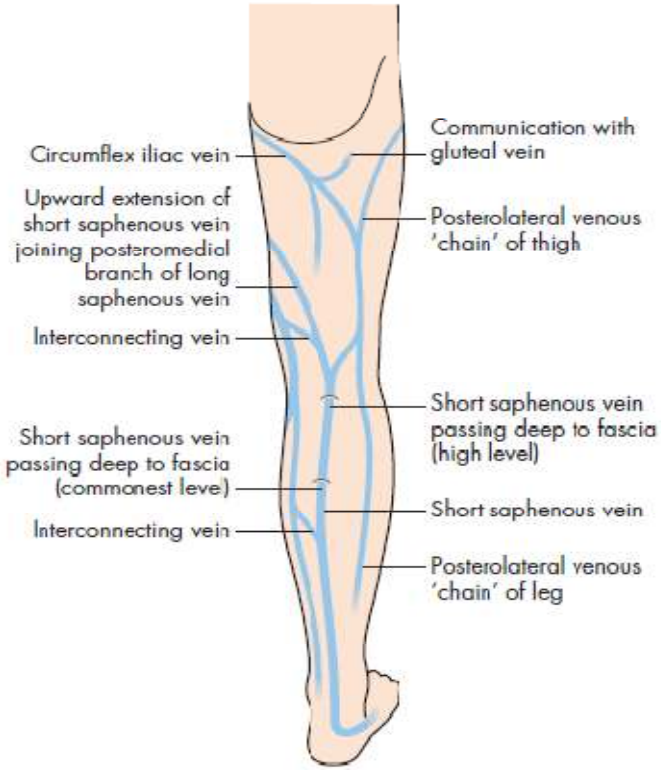


Figure 3: Venous Drainage (Posterior Aspect)

SUPERFICIAL VENOUS SYSTEM OF LOWER LIMB

Superficial veins form a network that connects superficial veins to deep veins. Superficial veins lie above deep fascia. The dorsal venous arch lies on dorsum of foot. It receives four dorsal meta tarsal veins, each of which is formed by union of two dorsal digital vein.

GREAT SAPHENOUS VEIN (GSV)[7]

This is longest vein in lower limb. It is formed by union of medial end of dorsal venous arch with medial marginal vein. It run upwards anterior to medial malleolus, crosses the lower one third of medial surface of tibia obliquely and run along its medial border to back of knee. The saphenous nerve runs in front of GSV

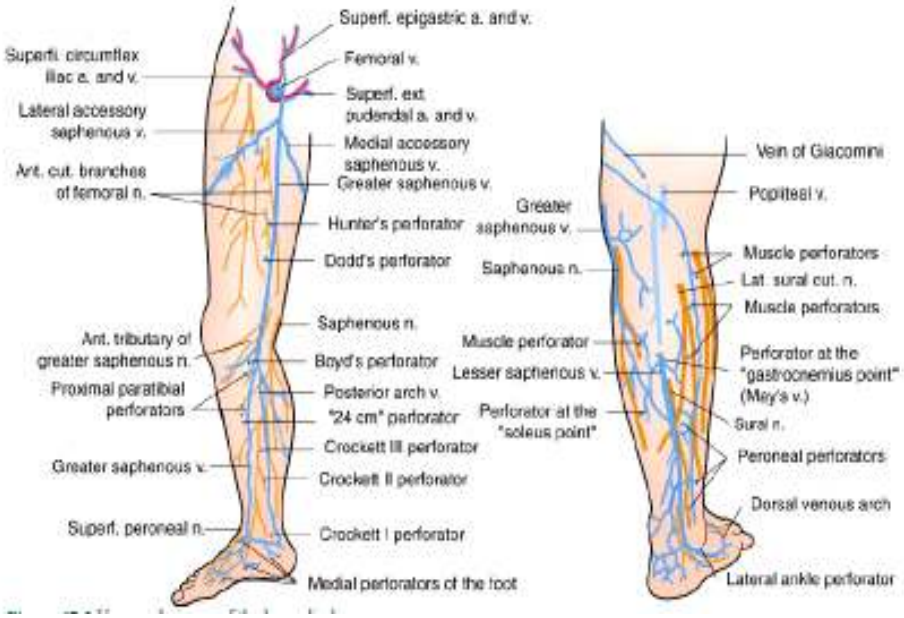


Figure 4: Great Saphenous Vein and Short Saphenous Vein

In the thigh, it inclines forwards to reach the saphenous opening where it pierces the crebriform fascia and opens into the femoral vein. Before piercing the cribriform fascia, it receives three named tributaries corresponding to the cutaneous arteries and also many unnamed tributaries. It contains about 10 to 15 valves which prevent back flow of the venous blood, which tends to occur because of the gravity. One valve is always present at the saphenofemoral junction. The saphenofemoral junction is present 2.5 to 3.5 cm below and lateral to pubic tubercle.

Incompetence of these valves makes the vein dilated and tortuous leading to varicose veins. The vein is also connected to the deep veins of the limb by perforating veins. The perforating veins are also containing valves. These valves permit flow of blood from GSV to deep veins. If those valves incompetent, will gives rise to varicose veins.

The saphenous nerve in leg and foot is anterior to GSV. The GSV is accompanied by the lymphatic trunk draining the dorsum of foot and anterior and medial aspect of the leg and thigh draining to superficial group of inguinal lymph nodes.

TRIBUTARIES

- **At the commencement** – medial marginal vein from the sole.
- **In leg** –free communication with SSV and Deep veins.

- **Just below knee – the anterior vein of the leg** runs upwards, forwards and medially, from the lateral side of the ankle.

The posterior arch vein of Dodd and Cockett (Leonardo's Vein) is large and constant. It begins from series of small venous arches which connect medial ankle perforators, runs upwards to communicate with GSV just below the knee. **In the thigh** – it receives two large tributaries which join it close to its termination. They are postero medial and antero lateral veins. Postero medial vein drains the postero medial side of the thigh. It may communicate with small saphenous vein. It receives numerous small tributaries from skin and subcutaneous tissue of popliteal fossa and upper half of the inner thigh. The anterior cutaneous vein of the thigh drains the lower part of front of thigh.

TERMINAL TRIBUTARIES

- Just before piercing the cribriform fascia superficial epigastric, superficial circumflex iliac and superficial external pudendal.
- Just before termination – deep external pudendal vein.

SHORT SAPHENOUS VEIN

The vein is formed on the dorsum of the foot by the union of lateral marginal vein with dorsal venous arch. It enters back of leg by passing behind the lateral malleolus. In the leg it ascends lateral to the tendocalcaneus and then along the middle line of the calf, to the lower

part of the popliteal fossa. It penetrate deep fascia to join the popliteal vein.

It drains lateral border of the foot, the heel and the back of the leg. It connected with great saphenous vein and with deep veins and is accompanied by sural nerve. The anatomical position of saphenopopliteal junction is variable significantly.

Tributaries – Several small vessels communicate with the short saphenous vein to venous arches on inner side of the leg. Small saphenous vein communicate to peroneal vein by a large constant lateral ankle perforator vein. It communicates with soleus sinusoids and therefore indirectly with posterior tibial and peroneal vein by an inconstant mid calf perforator. Small saphenous vein in its upper part communicates with GSV via posteromedial vein of thigh – vein of giocomini.

DEEP VEINS OF LOWER LIMB

The popliteal vein and femoral vein are major veins of lower limb and usually single conduits. They receive many tributaries from the surrounding muscles, corresponding with arteries. The veins draining muscles are valved with exception of those in soleus. The Soleus contains venous sinuses, they are non-valved and empty segmentally into posterior tibial and peroneal veins, sometimes directly into posterior tibial vein.At

resting stage of muscles there is sluggish flow of blood in the soleal sinuses.

The plantar digital veins in foot are drain into metatarsal veins which composes deep plantar venous arch. This continues into the medial and lateral plantar veins that then drain into posterior tibial veins. The dorsalis pedis veins on the dorsum of the foot form the paired anterior tibial veins at the ankle. The posterior tibial vein accompany posterior tibial artery, receiving veins from sural muscles, especially the venous plexus in the soleus, connections from superficial veins and peroneal veins. Veins from soleus and superficial veins drain into the peroneal vein.

Posterior tibial vein goes under fascia of deep posterior compartment. Then they enter soleus and link the popliteal vein, after joining with the paired peroneal and anterior tibial veins. There are large venous sinuses within the soleus muscle—the soleal sinuses—that empty into the posterior tibial and peroneal veins. There are bilateral gastrocnemius veins that empty into the popliteal vein distal to the point of entry of the lesser saphenous vein into the popliteal vein.

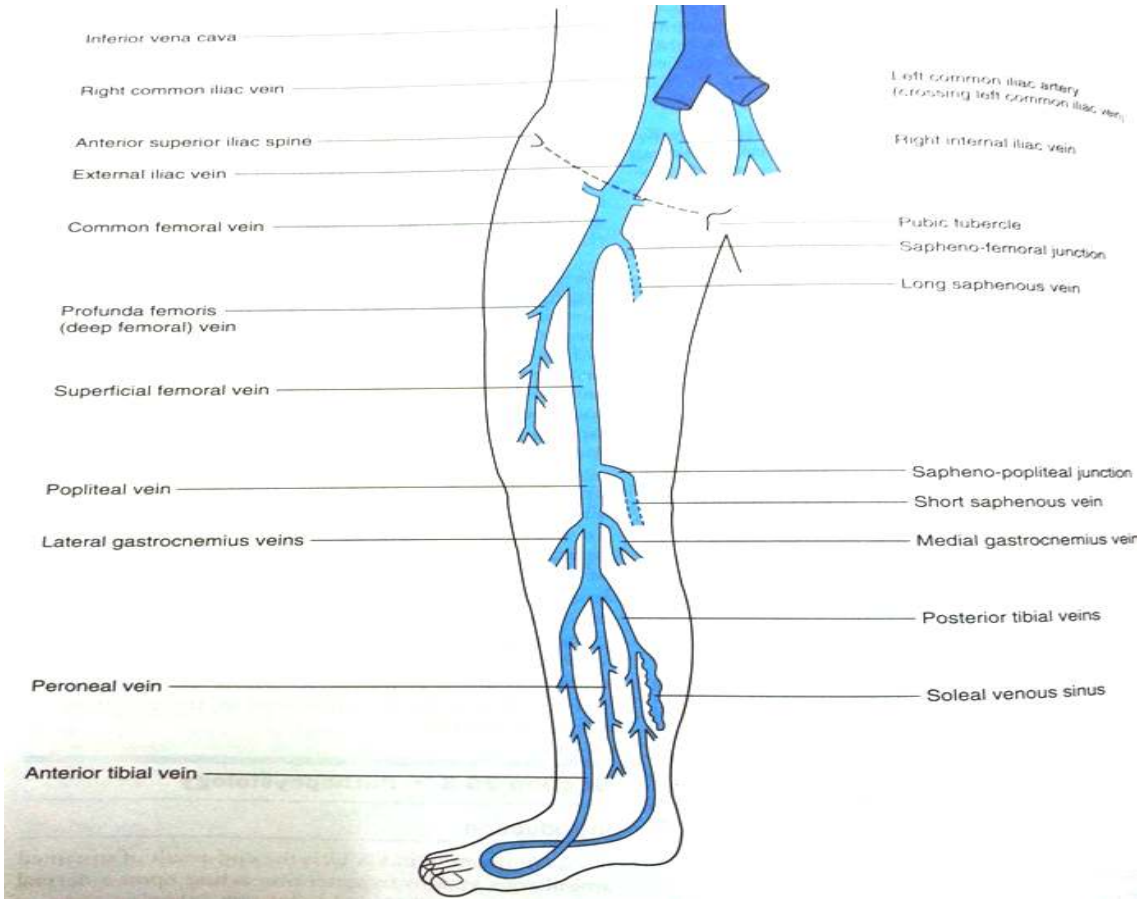


Figure 5: Deep Venous System

The popliteal vein enters a window in the adductor magnus, at which point it is termed the femoral vein. Popliteal vein in its distal part lies medial to femoral artery, between the heads of gastrocnemius it is dorsal to it, proximal to the knee joint it is postero lateral. There are 4 valves in popliteal vein. Popliteal vein tributeries are

- Small saphenous vein
- Veins corresponding to branches of popliteal artery
- Muscular veins

THE FEMORAL VEIN

The femoral vein goes together with femoral artery. It begins at the adductor opening as the continuation of popliteal and ending posterior to the inguinal ligament as external iliac vein. The femoral sheath middle compartment contains femoral vein.

The femoral vein ascends and receives venous drainage from the profunda femoris vein, or the deep femoral vein, and after this confluence, it is called the common femoral vein. As the common femoral vein crosses the inguinal ligament, it is called the external iliac vein. Lateral and medial circumflex femoral vein are tributaries of femoral vein.

INTERSAPHENOUS SYSTEM

It connects great saphenous vein and short saphenous vein. Previously it was called as vein of GioComini.

PERFORATOR SYSTEM[8]

The perforator veins normally allow blood to flow from superficial to deep venous system and in healthy subjects they are valved that they only permit blood to flow in one direction.

Two types of perforator are direct perforators and indirect perforators. The direct perforators are the one which passes straight from superficial vein to the main deep veins.

Perforators are called indirect when they connect superficial veins with deep veins through the muscular veins.

Direct perforator

The great saphenous vein and short saphenous vein are the large direct perforators. The small direct perforating veins are summarized below.

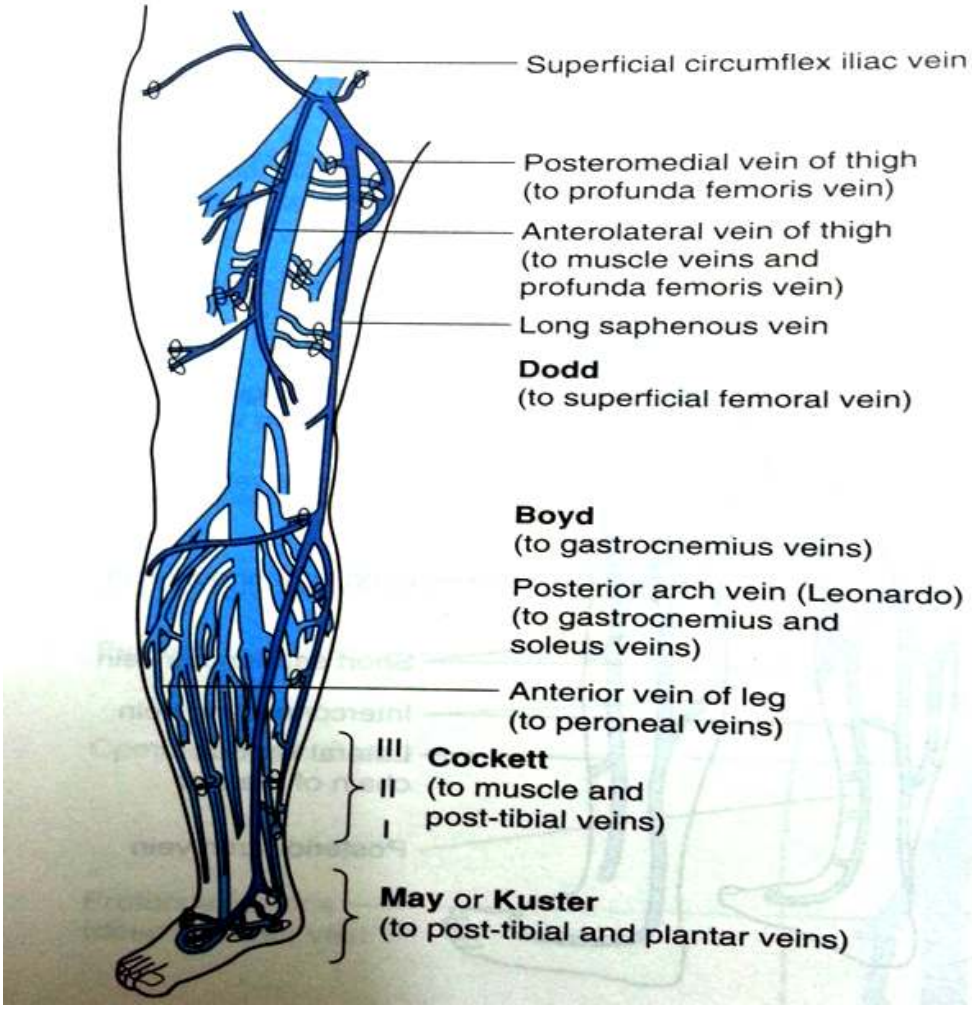


Figure 6: Lower Limb Perforators

In the thigh – There is a constant perforator vein which begins in the great saphenous vein or one of its tributaries about the middle to lower third of thigh and end in segment of femoral vein below the deep femoral valve in hunters canal – mid thigh perforator of DODD.

In the leg

BOYD Gastrocnemius perforator – just below the knee level, a vein usually runs close to the posterior border of tibia from the long saphenous vein or its large tributaries (Posterior Arch) to the posterior tibial vein which is constant.

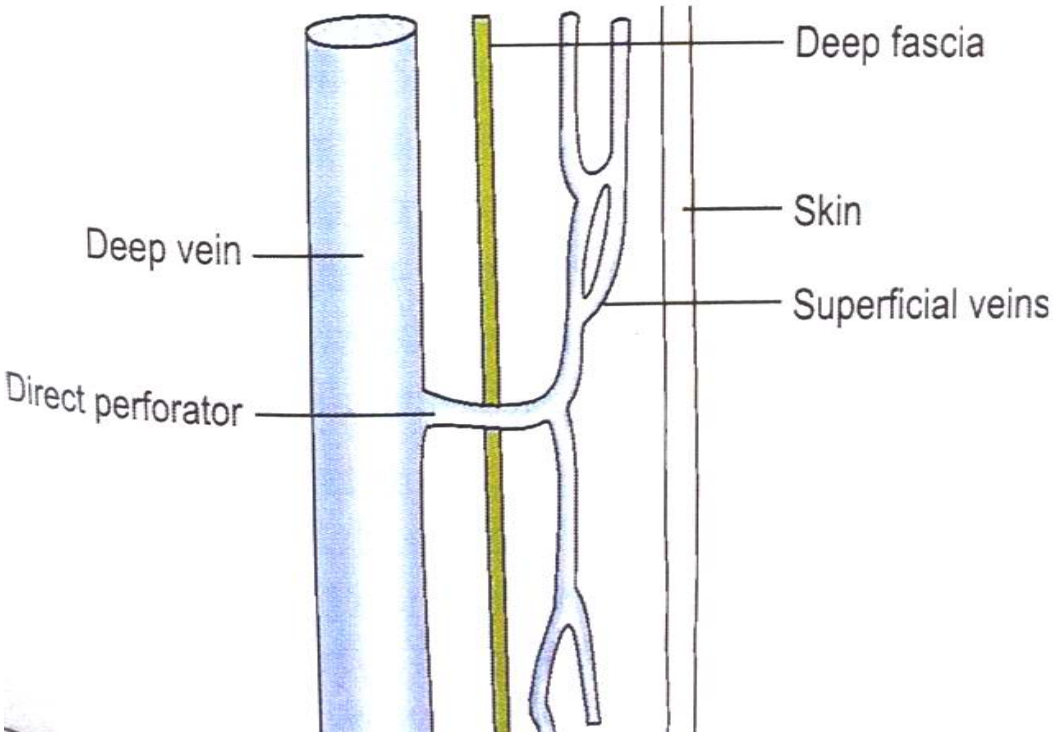


Figure 7: Direct Perforator Vein

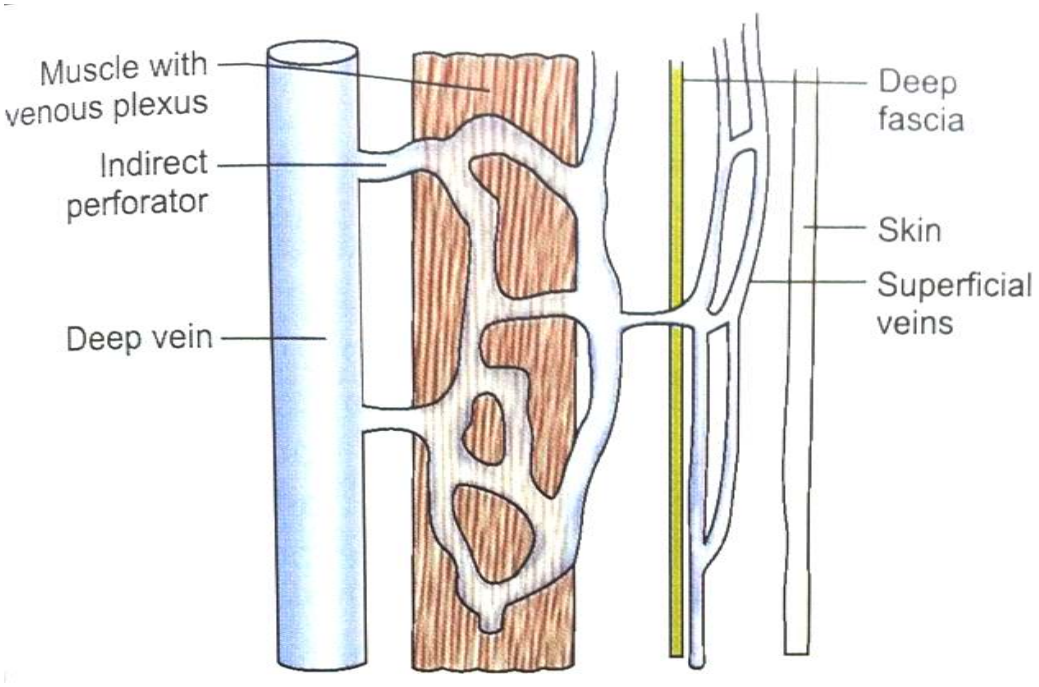


Figure 8: Indirect Perforator Vein

COCKETT lower leg perforator – in the distal half of leg there are direct perforators of clinical importance, which are known as internal and external ankle perforating veins. They are not isolated veins but vena communicates accompanying a perforating artery to the skin.

MAY or KUSTER ankle perforators [9]

These are usually present approximately 2, 4 and 6 cm from tip of medial malleolus.

Perforators related to SSV

Lateral or external ankle perforating vein is a constant large perforator which connects SSV to posterior tibial vein. This perforator plays a role in ulceration of lower third of leg.

THE VENOUS VALVES[11]

Valves in the superficial veins of the lower extremity are usually located near to the termination of major tributaries. The GSV contains about 10-15 valves, with more valves located below the knee. Valves in the SSV are closer to each other than in the GSV. Valves in the communicating branches between the SSV and GSV are oriented to direct blood from the Small to the Great saphenous vein. Like superficial veins, deep veins have more valves in the calf than in the thigh.

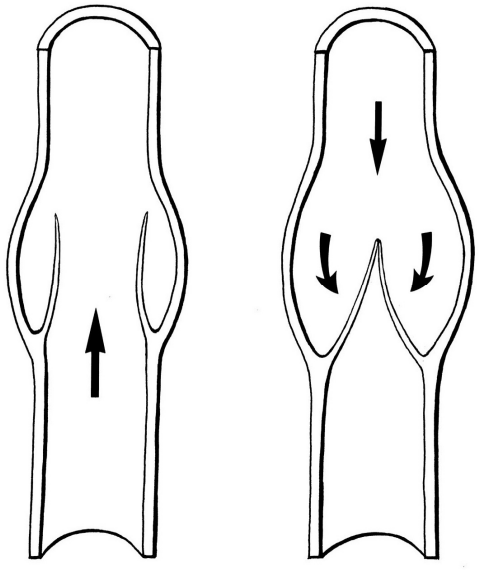


Figure 9: Venous Valve Structure

Tibial veins are densely packed with valves, whereas there are only 1 or 2 valves in the popliteal vein. In the Femoral vein there are 3-5 valves, with one of them located just distal to junction of deep femoral vein.

TYPES OF VALVES

1. Parietal valves (pocket valves) - These valves are tricuspid, formed along the course of the large venous trunk.

2. Ostial valves- These are present at the entry point of a small vein into the larger vein. There may be only one cusp.

STRUCTURE OF VALVE

It consists of the following parts,

- Cusp (leaf let)
- Agger (point of attachment of cusp to venous wall)
- Corne (projection of leaflet)
- Commisure (joining points of two cusps)
- Sinus- folds of cusp

PHYSIOLOGY OF VENOUS RETURN

The important functions of the lower limb veins are

- Transport of venous blood to heart form lower limb
- Reservoir for storage of blood

Factors responsible for venous return to heart are,

- The muscle pump
- Capillary pressure
- Muscle tone
- Negative pressure in thorax
- The competent valves
- Vis-a-tergo

Blood enters the limb through the femoral artery before passing through arterioles into capillaries, which have pressure of about 32 mm Hg at their arterial ends. This pressure is reduced along the course of capillaries and it is approximately 12mmHg at the venular end capillary. The pressure continues to fall as it approaches the heart and it is about -5mm Hg at the end of inferior vena cava where it enters into right atrium. The pressure of a vein in foot on standing position is related to blood column height extending from foot to heart and it is about 100mm Hg.[4]

The return of blood to heart from legs against gravity in the standing position is facilitated by muscle pumps. There are two muscle pumps in leg, most important one is calf muscle pump and other one is foot pump.

THE MUSCLE PUMPS

The calf muscle pump is the main pump which helps the blood to be returned to the heart from legs. The soleus and gastracnemius are importatant componants of calf pump. The calf muscles contraction causes forcible compression of soleus and gastrocnemius sinuses and blood propels towards heart. The pressure within calf compartment reaches 200-300 mm Hg when muscle contract.

When muscle in relaxed position, pressure in calf compartment falls and blood enters into deep veins from superficial veins through sapheno femoral junction, sapheno popliteal junction and through perforator veins. This causes fall in pressure in superficial venous compartment, this is normally about 20-39 mm Hg.[4]

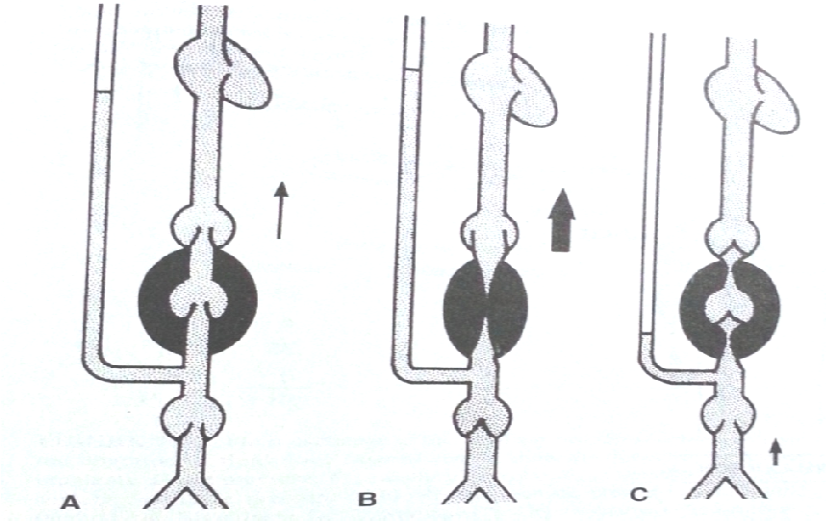


Figure 10: Muscle Pump
A) Rest B) Muscle Contraction C) Muscle Relaxation

This reduction of pressure is dependent on presence of patent perforators, patent deep veins and superficial veins, which must contains competent valves. The normally functioning vein valves prevent retrograde blood flow and maintain unidirectional blood flow towards heart. When there is failure of venous valves, patient develops venous disease and its symptoms.

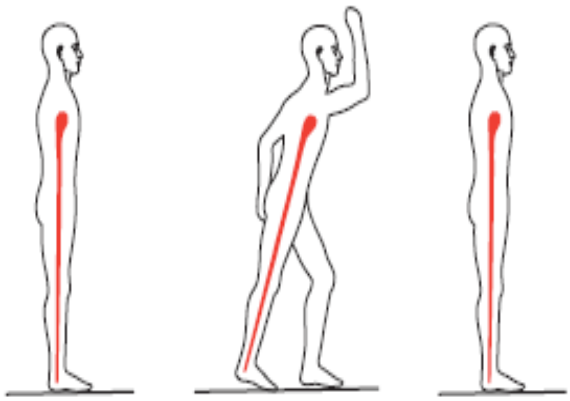


Figure 11 : Effect of Exercise on superficial venous system pressure

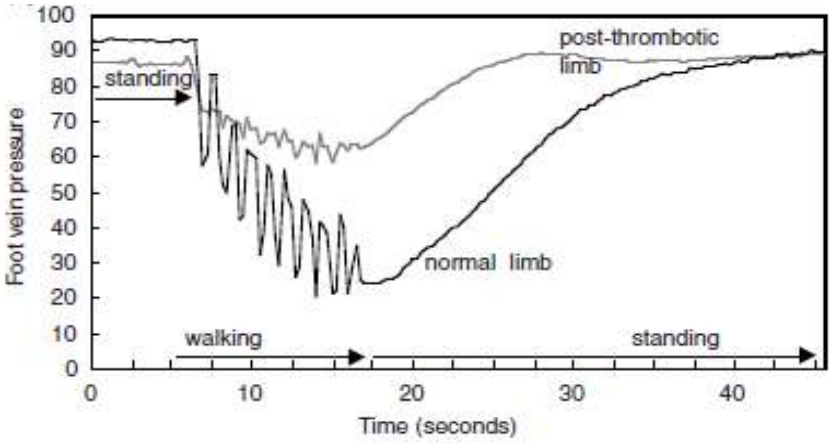


Figure 12 : Pressure Tracing of Calf Muscle Pump

The blood flow into deep veins occurs during the diastole of pump only. Negative intra thoracic pressure, - speed of venous blood flow return is increased by movements of respiration especially from upper limb. In man quite breathing has little effect on venous pressure in leg but deep inspiration lowers pressure.

THE RESERVOIR FUNCTION

It has been estimated that nearly one third of volume blood in the body is found in lower limb and this blood will be available for body in response to stimuli. This reservoir action will lost in varicose vein, even though more amount of blood is stored in dilated elongated vein as most stagnant and fails to react to many of stimuli. This stagnation of blood causes aching and cramping pain of varicose vein patients.

VARICOSE VEIN AETIOLOGY

Varicose veins may be classified as

- Primary
- Secondary
- Recurrent

PRIMARY VARICOSE VEIN

Varicose vein that develop spontaneously in the absence of identifiable cause are known as primary varicose vein. The great saphenous vein is involved more frequently. About 12% of primary varicose vein are associated with small saphenous system. Factors associated with etiology of primary varicose vein are

- Valvular incompetence
- Weakness of vein wall

The incompetence of valve may be localised are segmental. Varicosity of great saphenous vein is usually associated with saphenofemoral junction incompetence. Varicosity of small saphenous vein is usually associated with saphenopopliteal junction incompetence. Valvular incompetence leading to varicose vein may be confined to short segment of saphenous vein mainly GSV.

SECONDARY VARICOSE VEIN

Varicose veins that develop following deep vein thrombosis are known as secondary varicose vein. In deep vein thrombosis, the affected

part of vein wall and any contained valve are involved in a process of occlusion by thrombosis, fibrosis and recanalisation, subsequently results venous dilatation in all but the smallest veins. When the perforating veins are involved in this process and its protecting valve is destroyed a superficial varicosity may develop.

Causes of varicose vein are

- Heriditary [12]
- Race
- Sex
- Pregnancy
- Hormonal influence
- Posture
- Obesity
- Gravitational back pressure
- Primary valvular incompetence
- Incompetent perforating vein
- Weakness of vein wall
- Abnormality of vein wall
- Av fistula
- Secondary valvular incompetence

Sex

Some studies show that varicose vein appear to be more common in women. The Edinburgh vein study [13] (Evans, Fowkes,et al. 1999) and Bulgarian cross sectional survey (Zaharivev, Anastassov et al. 2009) showed higher prevalence of telangiectasia in women, but higher prevelance of trunk varicosities in men.

Race [14]

Varicose veins are more common in developed countries compared to developing countries. (Beebe-Dimmer, Pfeifer et al. 2005). The underlying reason for the racial and geographical variation is yet to be known, but may relate to genetic factors affecting vein wall.

Age [14]

With increase in age, there is increased incidence of venous disease (Beebe-Dimmer, Pfeifer et al. 2005). The increasing prevalence with increasing age is due to increased superficial venous pressure, due to calf muscle weakness and slow reduction of vessel wall strength. Chronic venous insufficiency prevalence increases with age mainly in men. Varicose veins among people aged below 30 years are below 1% for men and lower than 10% for female. From age 70 years and above, prevalence increased markedly to 57% to 77% (Fowkes, Evans et al. 2001).

Heridity [4]

Patients with FOXC2 gene inheritance are associated with development of this disease in 70 to 85% of first degree relatives, compared to 10% of those with no family history. Klippel-trenaunay syndrome, a valvulia, parkes-weber syndrome – here varicose veins are atypical in distribution.

Pregnancy

The correlation between varicose vein and pregnancy is strong with 10 to 20% of pregnant females developing varicose vein and upto 70% develop telangiectasias. Multiparous women are commonly developed varicosity. The harmone progesterone causes dilatation and relaxation of veins of the lower limb. This may make the valves more prone to incompetence. The hormonal effect is more in first trimester.

As the pregnancy advances uterus enlarge in size and it may cause compression on inferior vena cava and this may lead to secondary varicose vein. The spontaneous resolution is seen in most patients within 3 to 6 weeks after delivery. The hormones relaxin, oestrogen and progesterone are the principal players in this respect, having effects on venodilatation, venous stasis, valvular dysfunction, and possibly weakening the integrity of venous wall. (Vin, Allaert et al. 1992, Chapman, Abraham et al. 1998, Lenkovic, Cabrijan et al. 2009). [15]

Posture

In prolonged standing (more than 6 hours per day), the column of blood along with gravity put pressure on the vein valves, which leads to varicosity. The qualitative dysfunction of calf muscle pump mechanism also occurs due to prolonged standing. This causes failure of valves giving rise to varicosities.

Obesity [16]

The obesity is a risk factor for development of varicose veins, the effect appears to be more so in women (Brand, Dannenberg et al. 1988, Kontosic, Vukelic et al. 2000, Lee, Evans et al. 2003). Some studies prove that women with body mass index more than 30 Kg/m^2 are 3 times more prone to develop varicose veins. The effect may be due to the increased intra abdominal pressure in the obese (Noblett, Jensen et al. 1997), which results in decreased blood flow in pelvic veins, and therefore increased lower limb venous pressures (Fowkes, Lee et al. 2001).

Varicose vein recurrence [17]

Major cause of recurrence is faulty surgical technique. Failure to do adequate sapheno femoral junction flush ligation and failure to ligate all tributaries lead to recurrence.

Table : Causes of Varicose Vein Recurrence

Cause		Preventable
Inadequate Assessment	Deep vein Incompetence Deep vein occlusion Missed points of Incompetence Anatomical abnormality	Yes
Inadequate Surgery	Inadequate GSV Ligation Missed tributaries Thigh GSV not stripped Inadequate SSV Ligation	Yes
Progress of disease	New valvular incompetence	No

Other risk factors:

Sedentary life style and prolonged standing leads to varicose vein. Low fibre diet resulting in constipation, straining at stool may associate with varicose veins. Edinburg vein study found that long intestinal transit time low fibre diet and straining at stool are associated with an increased incidence of varicose veins. Height is a positive risk factor for varicosity and this is related to increased hydrostatic pressure. Lower limb fracture, systemic hypertension, smoking are some other risk factors that may be related to varicose veins.

PATHOGENESIS

The three fundamental mechanisms that lead to the sustained venous pressure are dysfunction of calf muscle pump, venous valvular reflux, and obstruction to venous blood flow. [18]

CALF MUSCLE PUMP DYSFUNCTION

Increasing age, musculo-skeletol deformity can impair the ability of calf muscle function, so impairment of muscle pump that lead to venous stasis. Transverse and longitudinal arch of the foot deformity can impair the venous foot pump. Muscle tone is vital for perforator competence. Incompetent perforators in the calf muscle leads to defect in muscle pump function.

VENOUS VALVE REFLUX

Venous valvular reflux in the superficial and/or deep veins is present in excess of 90% of patients with chronic venous insufficiency (CVI). In approximately a third to a half of cases this is confined to the superficial venous system. In the remainder, both systems are affected.

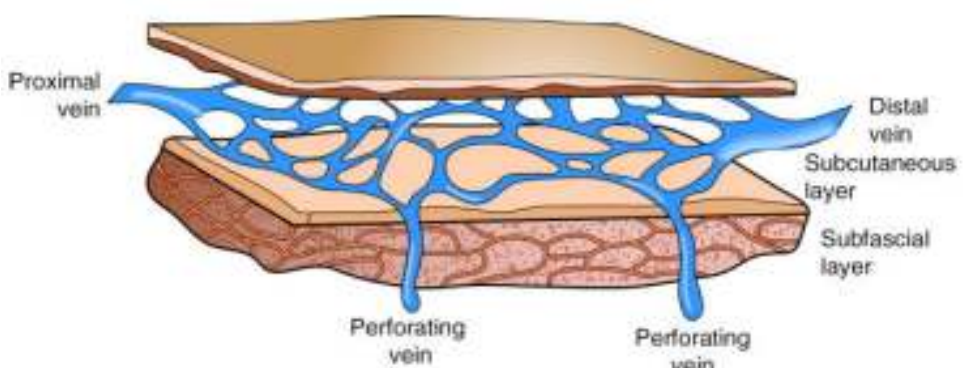


Figure 13: Incompetent Perforator Vein

PRIMARY VENOUS VALVULAR INCOMPETENCE

The reduction in elastin content and vein wall collagen weakening particularly along the commissures of valves, leads to valve leaflets separation, wall dilatation and reflux. Smooth Muscle Cell (SMC) present in varicose vein wall are well dedifferentiated, they demonstrate enhanced proliferative and synthetic capacity compared to SMCs present in normal veins [19]

SECONDARY VALVULAR INCOMPETENCE [4]

DVT is a common clinical entity and a clear history of DVT is found in about 20% of patients with CVU. Unknown number of people develops asymptomatic DVT without ever knowing it. The deep vein thrombosis leads to an inflammatory, possibly ischaemic phlebitis.

Partial or complete occlusion of the deep venous system with thrombus leads to flow through collaterals that are: valveless, thus permitting reflux, small diameter, so increasing the resistance to venous outflow.

Thus blood may return from the leg by being forced out from the deep compartment via perforators the distended so-called secondary varicose veins. Failure of haemodynamic compensation may quickly lead to the development of the post-throm-botic syndrome (PTS).

This comprises the skin changes of CVI leading to ulceration, swelling and a bursting discomfort in the leg following exercise relieved only by resting and elevating it (venous claudication).

CONGENITAL VARICOSE VEIN [4]

Varicose veins are associated with several congenital syndromes such as Klippel Trenaunay syndrome and Parkes Weber syndrome. Klippel - Trenaunay syndrome is a non-familial mesodermal anamoly, characterized by soft tissue and bone hypertrophy, varicose veins, and capillary port-wine stains; this syndrome appears to be the most common of the congenital abnormalities associated with varicose veins. Parkes Weber syndrome present with varicose vein, multiple AV fistulas, chronic venous hypertension, high output cardiac failure and ulceration. In these syndromes, absent or hypoplastic deep veins may present, such that malformations acts as the primary venous outflow from the leg. The management of these conditions is mainly conservative[1] with compression hosiery, limited stab avulsion of symptomatic varices after thorough Duplex USG scanning.

VENOUS ULCER MECHANISM

Venous disease is responsible for 60 to 70 percent of ulcers in the lower limb. There are other causes for leg ulcers like aterial ulcers, rheumatoid ulcer, traumatic, diabetic ulcer, neoplastic ulcers.

There are two theories explain venous ulceration that are

- White cell trapping theory
- Fibrin cuff theory

WHITE CELL TRAPPING THEORY[20]

This theory was proposed by Coleridge Smith and his colleagues. White cells are bigger and less deformable than red blood cells. The haemodynamic effect of white cell has greater effect on blood flow through a narrow channel such as capillary. If the perfusion pressure across the capillary bed is reduced due to an increase in venous pressure, white cells plug the capillaries and red cells build up behind. On reaching the post capillary venule, the white cells are forced to marginate by the red cells. Adherence of white cells to the endothelium is then stimulated by

- Decreased shear forces.
- Up-regulation of adhesion molecules by endothelium as a response to venous hypertension.

The inappropriate activation of trapped white cells release proteolytic enzymes and oxygen free radicals, causing endothelial and tissue damage. Tumour necrosis factor α and interleukine 1 (IL-1) are released by activated monocytes. These agents may produce endothelial

cell activation to permit the passage of much larger than normal molecules. The patients with venous disease shows reduced fibrinolytic activity due to IL-1 effect. The endothelial cells are stimulated to produce plasminogen activator inhibitor I. This activation of endothelial cells is by IL-1. IL-1 also reduces the plasminogen activator production and thereby cause reduced fibrinolysis.

As a consequence there is release of vascular endothelial growth factor. This cause increased microvascular permeability, which may explain the presence of a fibrin cuff, and also produces excessive amounts of nitric oxide. Fibrin deposition, tissue death, scarring occurs together called as lipodermatosclerosis. Recently, McCollum demonstrated that in patients with chronic venous insufficiency and increased venous pressure in leg veins, have up regulation in oxygen free radicals production by neutrophils and also enhanced production of thromboxane A2.

FIBRIN CUFF THEORY [21]

In 1982, Browse and Burnand proposed that oxygen diffusion into cutaneous tissues was restricted by a pericapillary fibrin cuff. They suggested rise in venous pressure is directly transmitted to the capillary bed. This results in an increase in the endothelial surface area available for exchange and allows the passage of larger molecules i.e. fibrinogen out of the intravascular compartment into the tissues.

Fibrinogen then polymerizes to produce the `fibrin cuff' that surrounds cutaneous capillary walls. Measurements of capillary protein loss by Browse and Burnand showed that fibrinogen was generally important plasma protein leaking into tissues in patients with venous disease. Successive measurements of fibrinolysis have shown that patients with venous disease have decreased venous fibrinolytic activity, which might explain why the fibrin cuff persists.

The fibrin cuff theory suggests venous ulceration is related to deprivation of oxygen in tissues. The possible mechanism for frank ulceration of lipodermatosclerosis lies with the enzymes matrix metalloproteinases. These enzymes help remodel the extracellular matrix by protein degradation, and enhanced activity of these enzymes has been demonstrated in lipodermatosclerosis. The ambulatory venous hypertension is the only accepted cause of ulceration. The venous hypertension may be the result of primary valve incompetence of saphenous veins, incompetence of perforating veins or incompetence or obstruction of the deep veins.

INCOMPETENCE OF VENOUS VALVES

- Stasis of blood
- Chronic ambulatory venous hypertension
- Defective micro circulation

- RBC diffuses into tissue plane
- Lysis of RBC
- Release of haemosiderin
- Pigmentation
- Dermatitis
- Capillary endothelial damage
- Prevention of diffusion and exchange of nutrients
- Severe anoxia
- Chronic venus ulceration

CHRONIC VENOUS INSUFFICIENCY (CVI)

It is a syndrome resulting from continuous chronic venous hypertension/ambulatory venous hypertension (more than 80mm Hg venous pressure at ankle) in the erect posture either on standing or exercise (in normal person venous pressure in the superficial system falls during calf muscle contraction). CVI consists of postural discomfort, varicose vein, oedema, pigmentation, induration, dermatitis, lipodermatoclerosis and ulceration.

Classification of varicose vein[22]

Classification I

Based on system involvement,

- Great saphenous vein varicosity
- Small saphenous vein varicosity
- Varicose vein due to perforator incompetence

Classification II

Based on size,

- Thread veins [dermal flare/telengiectasis/spider veins] size 0.5-1mm. These are small varices in the skin usually around the ankle which look like dilated red or purple network of veins thread veins are common in females.
- Reticular veins 1-4mm in size .they are slightly larger than thread veins located in subcutaeneous regions
- Varicose veins –dilated, palpable, subcutaneous veins more than 4mm in size.
- Combination of any of these
- Corona phlebectatica are blue telengictasia on medial aspect of foot below the malleolus around ankle level .more than five such lesions are independant predictor of skin changes.

The CEAP (Clinical-aEtiology-Anatomy-Pathophysiology) classification was formed in 1994 by an international ad hoc committee of the American Venous Forum, and authorized by the Society for Vascular Surgery. It was included into the Reporting Standards in Venous Disease in 1995. The aim was to achieve uniformity in reports of management of venous diseases, as well as correctly diagnose, and systemically guide the daily clinical investigation, decision making and

appropriate management of patients with venous disorders (Beebe, Bergan et al. 1996).

The basic CEAP classification was refined in 2004 to include the division of C4 into 2 subclasses to reflect the severity of disease and risk for ulcer development; the introduction of a descriptor "n" for E, A, and P classification, where no venous abnormality is identified (Eklof, Rutherford et al. 2004). The CEAP classification is summarised below:

Clinical classification (C0-6)[10]

C0 No visible or palpable signs of venous disease

C1 Telangiectasias or reticular veins

C2 Varicose veins

C3 Edema without skin changes

C4 Skin and subcutaneous tissue changes ascribed to venous disease

C4a Pigmentation or eczema

C4b Lipodermatosclerosis or atrophie blanche

C5 Skin changes as above, with healed ulceration

C6 Skin changes as above, with active ulceration

Each limb is further characterised as asymptomatic (A), or symptomatic (S). The higher clinical classes have more severe signs, and may also have features of a less severe class.

Etiologic classification

Ec Congenital

Ep Primary

Es Secondary

En No venous cause identified

Venous dysfunction may be congenital (c), primary (p), or secondary. Congenital disorders are present at birth, but may not be diagnosed until later. Primary venous dysfunction is of unidentified cause (not congenital).

Anatomic classification

As Superficial veins

Ap Perforator veins

Ad Deep veins

An No venous location identified

Multiple venous systems might be involved, in any combination.

Pathophysiologic classification

Pr Reflux

Po Obstruction

Pr, o Reflux and obstruction

Pn No venous pathophysiology identified

CLINICAL FEATURES

The clinical presentation of varicose vein varies among the patients. Patients may present with asymptomatically, symptomatically and with complications.

Asymptomatic patients presents with cosmetic problem. Edinburgh venous study has revealed most common symptom was aching in women 53% and cramps in men 34%.[17]

Asymptomatic patient present with

- Venous telangiectasia
- Visible varicose veins

Symptomatic patient present with

- Aching on standing
- Heaviness in the leg
- Itching
- Cramps
- Swelling
- Restless legs
- Tenderness
- Paraesthesia

Patients may present with complications like

- Bleeding
- Superficial phlebitits
- Ankle venous flare
- Atrophie blanche
- Venous eczema
- Pigmentation
- Periostitis
- Lipodermatosclerosis
- Venous ulcers
- Equinus deformity
- Calcification of vein

PIGMENTATION[23]

It is commonly seen in the gaiter area which is brownish to black in colour. The red blood cells extravasation into dermis leads to lysis of red cells and haemodiderin deposition in dermis causes pigmentation of skin. Increased ambulatory venous pressure permits red cell extravasation.

ECZEMA-CHRONIC DERMATITIS

It may present as an acute exudative diffuse or discoid eczema to a most chronic lichenified form.

LIPODERMATOSCLEROSIS[1]

Browse and Burnand coined the term, Lipodermatosclerosis to describe progressive induration, inflammation and pigmentation, corresponding to excessive fibrosis of the skin and subcutaneous tissues which are induced by chronic venous hypertension.[23] The skin is thickened and tight with fixed to hard, indurated fibrosing subcutaneous tissues. Progressive subcutaneous fibrosis gives the leg an inverted champagne bottle appearance.

VENOUS ULCERATION

Venous ulceration of lower leg is the consequence of steadily elevated venous pressure and its secondary effects on the microvascular system.

HAEMORRHAGE

Trivial injury to dilated veins may lead on to profuse bleeding The bleeding may be profuse due to high pressure within varicose vein. Simple elevation of the leg and the application of a firm pad and bandage easily control the bleeding. On no account should a tourniquet be used.

PHLEBITIS

This may occur spontaneously or secondary to minor trauma. In this condition, varicose vein become extremely tender and firm. The overlying skin becomes red and oedematous. It may be associated with pyrexia and malaise.

PERIOSTITIS

Periostitis causes thickening of periosteum. It delays the healing of ulcer due to poor perfusion of ulcer bed. It is often a coincidental finding observed in plain radiography.[24]

EQUINUS DEFORMITY

This only result from long standing varicosity. When the patient finds that walking on the toes relieves pain, he continues to do so and ultimately the Achilles tendon becomes shorter to cause this defect. [24]

CALCIFICATION OF VEIN

This is occasionally seen in the walls of the veins, which are varicosed for many years. [25]

CLINICAL EXAMINATION

INSPECTION

Patient examined in standing position. Inspection should be performed in planned way, usually starting from distal to proximal and from front to back. The perineal region, pubic region, and abdominal wall also have to be inspected. The varicose veins become prominent when the patient stands up.

In inspection look for whether varicosity has affected the great saphenous vein or small saphenous vein or only localized. Varicosity of GSV system is seen on the medial side of the leg and thigh while that of short saphenous system is seen on postero lateral aspect of the leg. In a long-standing case however, because of liberal communication between two systems, varicosity in one may spread to the other.[26]

On inspection look for cutaneous ulceration, telangiectasias, acrocyanosis, eczema, brown spots, acro dermatitis, flat angiomata, prominent varicose veins, scars from a prior surgical operation, or evidence of previous sclerosant injections. All visible lesions should be measured and photographed. Healthy veins typically are visible distended only at the foot and ankle. Visible distension of superficial veins in other regions of the leg usually implies disease. The pigmentation of skin is

often a sign of chronic venous stasis. Ulcer over gaiter area usually implies saphenofemoral junction incompetence.

PALPATION

The whole surface of the skin is palpated lightly with fingertips since dilated veins are palpable even when they are not visible. Palpation facilitates to locate both normal and abnormal veins. After light palpation to identify superficial vascular abnormalities, deeper palpation aids to explain the causes and sources of the superficial problems. Palpation begins over the anteromedial surface of the lower limb by the side of the territory of the great saphenous vein and then proceeds to the lateral surface, where collateral varicose veins of the saphenous trunk possibly found along the non- saphenous varicose veins.

At last, the posterior surface is palpated in the territory of SSV. The location, size shape, and course of all varicosities are noted, and the diameter of largest vessel is measured precisely. Distal and proximal arterial pulses are too palpated. The saphenofemoral junction might be palpable in patients with truncal reflux at the SFJ. It is best-palpated two fingerbreadths below the inguinal ligament and just medial to the femoral artery.

If reflux is present, on cough an expansile impulse may be felt at saphenofemoral junction. The small saphenous vein might be palpable in popliteal fossa in some slender patients. On palpation of leg, may disclose a firm, thickened, thrombosed vein. These palpable thrombosed vessels are superficial veins but relating DVT may exist in 40% of patients with superficial phlebitis.

Look for pitting edema or thickening, redness or tenderness at the lower part of the leg. These changes are due to chronic venous hypertension following deep vein thrombosis. Sometimes a progressive sclerosis of the skin and subcutaneous tissue may occur due to fibrin deposition, tissue death and scarring. This is known as lipodermatosclerosis and is also due to chronic venous hypertension. This may follow formation of venous ulcer.

PERCUSSION

The venous percussion is helpful to identify whether the venous segment is patent or not. The spread of a palpable pulse wave exhibits a patent superficial venous segment with incompetent valves connecting two positions.

Brodie -Trendelenburg test

This test has two parts; Brodie-Trendelenburg test 1 and Brodie-Trendelenburg test 2. This test is done to decide the incompetency of the saphenofemoral junction and other communicating systems.

In both tests, the patient is first placed in the supine position and his legs are raised to empty the veins. The sapheno-femoral junction is now compressed with the thumb of the clinician or a tourniquet is applied just below the sapheno-femoral junction and the patient is asked to stand up quickly. In Brodie-Trendelenburg test 1, the pressure is released. If the veins fill quickly by a column of the blood from above, it indicates incompetency of the saphenofemoral junction. This is called a positive Trendelenburg test.

In Brodie-Trendelenburg test 2 - to test the communicating system, the pressure is not released but maintained for about one minute. Gradual filling of the veins during the period indicates incompetency of the communicating veins, mostly situated on the medial side of the lower half of the leg allowing the blood to flow from the deep to the superficial veins. This is also considered as a positive Trendelenburg test. These positive tests are indication for surgery.

In case of small saphenous system, the small saphenous vein enters the popliteal vein by a narrow channel, which passes through the fibrous

roof of the popliteal fossa. The popliteal vein has several valves. The small saphenous vein always refills slowly even if it is varicose.

Multiple Tourniquet test

It can be called a variant of Trendelenburg test. In this test the tourniquet is tied round the thigh or leg at different levels after the superficial veins have been made empty by raising the leg in supine position. The patient is now asked to stand up. If the veins above the tourniquet fill up and those below it remain collapsed, it indicates presence of incompetent perforator veins above the tourniquet. Similarly if the veins below the tourniquet fill rapidly whereas veins above the tourniquet remain empty, the incompetent perforator vein must be below the tourniquet. Thus by applying the tourniquet at different levels one can determine the position of the incompetent perforator vein.

Small saphenous incompetence - Application of the venous tourniquet to the upper thigh has the paradoxical effect of increasing the strength of the reflux, as shown by faster filling time. The sign, which has not been described before, is pathognomic of varices of the short saphenous system.

Perthes' test

The affected lower extremity is wrapped with elastic bandage. With the elastic bandage on, the patient is instructed to move around and exercise. Development of severe cramp like pain in calf muscle indicates deep vein thrombosis.

Modified Perthes' test

A tourniquet is tied just below the saphenofemoral junction without emptying the vein. The patient is asked to walk quickly with the tourniquet in place which precipitates bursting pain in the calf also makes superficial veins more prominent. It indicates deep vein thrombosis.

Schwartz test

In standing position, when lower part of the long saphenous vein in leg tapped, impulse is felt at the sapheous junction or at the upper end of the visible part of the vein. It signifies continuous column of blood due to valvular incompetence.

Pratt's test

This test is done to locate the positions of the leg perforators. Initially, an esmarch elastic bandage is applied from toes to the groin. A tourniquet is then applied at the saphenofemoral junction. This causes emptying of the varicose veins. The tourniquet is kept in position and the

elastic bandage is taken off. The same elastic bandage is now applied from the groin downwards. At the positions of the perforators 'blow outs' or visible varices can be seen. These are marked with skin pencil.[26]

Morrissey's Cough Impulse Test

The limb is elevated to empty the varicose veins. The limb is then put to bed and the patient is asked to cough forcibly. An expansile impulse is felt at saphenofemoral junction if saphenofemoral valve is incompetent.

Fegan's test

On standing, the site where the perforators enter the deep fascia bulges and this is marked. Then on lying down, button like depression in the deep fascia is felt at the marked out points which confirms the perforator site.

Homan's sign

If deep vein thrombosis is suspected, dorsiflexion of the foot causes pain. If the pain is present the sign is positive. It may also be positive in conditions other than deep vein thrombosis.

Moses's sign

Gentle squeezing of the relaxed calf muscles from side to side is painful in DVT.

AUSCULTATION

Auscultation over the course of the distended veins may reveal A-V fistulas.

REGIONAL LYMPH NODES (inguinal)

Inguinal lymph nodes are enlarged if there is infected venous ulcer.

OTHER LIMB

Other limb should be examined for the presence of varicose veins and different tests to exclude deep vein thrombosis, incompetent perforators and venous ulcer to plan treatment.

EXAMINATION OF THE ABDOMEN

It is the most important part of the general examination. Sometimes a pregnant uterus or intrapelvic tumor (fibroid, ovarian cyst, cancer of cervix or rectum or abdominal lymphadenopathy) may cause pressure on the external iliac vein and becomes responsible for secondary varicosity.

PERIPHERAL ARTERIAL PULSES

Pulses should be examined to exclude presence of arterial insufficiency. Ulcers in the lower limb with presence of varicose veins may not necessarily be the venous ulcers and such ulcers may occur due to ischemia from the arterial insufficiency and are known as arterial ulcers.

INVESTIGATIONS

Various investigations can be carried out to know the condition of deep vein and superficial venous system.

SPECIFIC NON INVASIVE INVESTIGATIONS

DOPPLER USG

It is the minimum required investigation. A number of Doppler flow meters are commercially available. The purpose of continuous - wave Doppler[27] examination is to know the relationship of existing varicose veins to the saphenous system, to demonstrate the presence and duration of reflux in the SFJ incompetence[28] and to know whether deep venous system is obstructed.

For optimal results, the patient should be in a standing position as it allows filling of incompetent venous reservoirs so that when compression of these reservoirs is released, flow can be detected with the Doppler probe.

DEMONSTRATION OF VALVULAR INCOMPETENCE

There are two methods of demonstrating valvular incompetence.

- By Valsalva maneuver
- By applying compression

VALSALVA MANEUVER

Valsalva maneuver will cause the blood to flow retrograde in the veins to the site of the probe, provided the intervening valves are incompetent. It is most easily demonstrated in the more proximal veins.

BY APPLICATION OF COMPRESSION

This method involves compression of leg proximal to the site of probe. In the presence incompetent valves between the compression site and the probe, a retrograde surge of blood will be detected during compression. Upon release of compression blood will again flow, thus producing to and fro signal. A similar to and fro signal can be produced by compression performed below the probe site.

In this case, blood forced cephalad during compression returns to fill the void in the empty veins when pressure is released. The prolonged retrograde signal > 0.5 second is abnormal and considered positive for valve incompetence. A Doppler can be used to assess the patency and competence of deep venous system and also to exclude arterial disease.

The Advantages are

- Non invasive
- No radiation
- Low cost of instrument

- Easy to handle
- Safe to use in all patients

PLETHYSMOGRAPHY

Plethysmography[29] is the term given to the recording of changes in the size of a limb. There are two main factors causing significant variation in the volume of a limb within a short space of time:

- Changes in the tissue fluid, for example, the accumulation or loss of edema.
- Changes due to the volume of blood pooled within the veins.

Under normal conditions, venous refilling occurs through arterial inflow alone, a slow process taking 20 or 30 seconds when the limb is at rest. In patients with venous incompetence, the veins also fill via venous reflux, which speeds the refilling process. Fast refilling time means that one or more veins in the leg are incompetent.

Plethysmography[29,18]

TYPES

- Photo plethysmograpy
- Fluid plethysmography
- Air Plethysmography.
- Electrical impedance plethysmography

- Strain guage plethysmography
- Light reflection rheography.

DUPLEX USG[30, 33]

Presently, Duplex USG is standard for the diagnosis of venous disorders. It is valuable non invasive tool, simple in application. This technique combines B-mode real time ultrasonography with pulsed Doppler ultrasonography. It is precise than continuous-wave Doppler ultrasound as it can identify presence or absence of reflux at anatomically known sites. A 7.5-MHz imaging probe with 5.0-MHz pulsed Doppler wave is employed. The saphenofemoral junction is examined first with patient standing, facing the examiner with more weight placed on the opposite limb.

The probe is placed longitudinally on the groin pressing lightly with the intention that the femoral vein, long saphenous vein, and their junction could be recognized. Two features can be identified in real-time imaging: the movement of red cell aggregates revealed as echogenic intraluminar structures going slowly cephalad; and the movement of the venous valves during respiration. The colour flow imaging is then switched on. The pulsatile flow in the arteries turns into noticeable (red).

Distal compression end in augmentation of venous flow and increased Doppler shift frequency, which is assign a colour (blue for flow

toward the heart). Rapid release of the distal compression reveals reflux as a different colour (red), indicating flow away from the heart. The Duplex color flow imaging is sometimes called triplex USG.

Similarly short saphenous and popliteal veins are examined with knee of side to be inspected is flexed slightly so that the popliteal fossa is relaxed with the weight mainly on the opposite limb.

COMPUTED TOMOGRAPHIC VENOGRAPHY [34]

CTV is generally limited to anatomic information of veins between the iliac crest and knees, and therefore cannot assess reflux or pathology in calf veins. CTV is not currently being used to assess CVD. Its role appears to be limited to evaluate for DVT in patients as a venous thromboembolic (VTE) source, assessment of venous anatomy in post-operative varicose vein recurrence, or in evaluation for May-Thurner syndrome.

INVASIVE INVESTIGATIONS

AMBULATORY VENOUS PRESSURE STUDY[22]

It is an invasive method. Needle is inserted into dorsal vein of foot is connected to transducer to get its pressure which is equivalent to pressure in the deep veins of the calf. 10 tiptoe manoeuvres are performed by patient. With initial rise in pressure, the pressure decreases and

eventually stablises with a balance. Pressure now is called as ambulatory venous pressure (AVP).

After stopping exercise, veins are allowed to refill with return of pressure to baseline. Time required for pressure to return to 90% of baseline is called as venous refilling time. A rise in AVP signifies venous hypertension. Patients with AVP more than 80mm Hg has got 80% chances of venous ulcer formation.

PHLEBOGRAPHY

First venograms were performed in man by Robrerich and Hirsch in 1923 using strontium bromide as the contrast medium.

Indications

- To aid in diagnosis of acute thrombophlebitis when clinical findings are equivocal.
- To diagnose previous thrombophlebitis.
- Selection of therapy in complicated varicose vein problems.
- To diagnose chronic unexplained edema of the leg.
- To study the natural history of thrombophlebitis.

Types

- Ascending
- Desending

Table 2. Categories of deep venous reflux on descending venography

Grade	Description
0	No reflux below junction of superficial and profunda femoris veins.
1	Reflux into superficial femoral vein but not below midthigh.
2	Reflux into superficial femoral vein below midthigh but not into popliteal vein. (Competent popliteal valves).
3	Reflux into popliteal vein past level of knee. (Incompetent popliteal valves but competent valves in the axial calf veins)
4	Reflux throughout the axial veins (femoral, popliteal, and calf) to the level of the ankle.

MAGNETIC RESONANCE PHLEBOGRAPHY

Magnetic resonance (MR) imaging represents a new modality for the diagnosis and evaluation of vascular disorders. MR phlebography has several advantages over conventional phlebography. It is less invasive and therefore has lower morbidity. When gadolinium enhancement is not used, venous access is not required. It allows for greater distinction of acute from chronic thrombosis, the identification of other soft tissue pathology, and potential for serial examinations to monitor disease progress and response to therapy. In comparison with duplex

ultrasonography, currently the most widely used diagnostic modality; MR phlebography allows imaging of pelvic veins and the inferior vena cava, which is not possible with ultrasonography. With the use of gadolinium enhancement, it may well allow for more accurate determination of clot age.[30]

RADIONUCLIDE SCINTIGRAPHY

Radionuclide studies carried out in vivo may be divided into those primarily concerned with counting local concentrations and those, which involve imaging[35]. The lower limb superficial venous system can be investigated by technetium-99m red blood cell blood pool imaging.

Imaging of the blood pooled in the vessels of the limb is performed shortly after, with the patient standing to fill the veins maximally. This method proved particularly useful in visualizing the varicose veins of obese patients in whom there was difficult to obtain sufficient information.[36]

VARICOGRAPHY

This is particularly useful in patients with vulval varicosities, recurrent varicose veins or those who have abnormal refluxing veins, often on the posterior surface of the thigh, which arises from the profunda

vein or more proximally and in peri-operative localization of the sapheno-popliteal junction.

INTRAVASCULAR ULTRASOUND[37]

Intravascular ultrasound (IVUS) is more advanced than the single- and multi-plane venography in diagnosis of the extent and types of morphologic lesion of the vein. In selecting symptomatic patients for IVUS investigation, one or many of these parameters have been used:

Single-plane venographic stenosis > 30%

- Presence of pelvic collaterals; and
- Positive invasive pressure test.

FUNCTIONAL CALF VOLUME MEASUREMENTS

The ultimate factor leading skin changes and ulceration is venous hypertension. The various tests available for measurements of functional calf volume are:

- Ambulatory venous pressure measurement: The magnitude of AVP reflects the severity of CVI. The patients with AVP of >80 mmHg have 80% chance of developing venous ulceration.[38]
- Plethysmography.
- Foot volumetry.

ROUTINE INVESTIGATIONS

A. Blood

1) Hemoglobin level.

2) Total and differential count.

3) Blood grouping and cross matching.

4) Blood urea and sugar.

B. Routine Urine

Pre-treatment evaluation should provide information regarding.

- Type of varix - Great / short saphenous or both.
- Source of varix - SFJ / SPJ / Perforator incompetence.
- Accurate localization and marking of incompetence with ink.
- Deep venous status.
- Peripheral arterial system status.

TREATMENT OF VARICOSE VEINS

Aim of treatment for an individual with varicose veins should consider the likely benefits of a particular intervention in three areas:

- Cosmetic improvement
- Symptomatic improvement
- Prevention of progression of venous insufficiency and venous ulceration.

Indications for therapeutic intervention are listed below. [1]

- Cosmetic appearance
- Aching pain
- Leg heaviness
- External bleeding
- Superficial thrombophlebitis
- Ankle hyper pigmentation
- Lipodermatoselerosis
- Atrophie blanche
- Venous ulcer

Different modalities in treatment options for management of varicose veins are:

- Reassurance with or without analgesia
- Lower limb elevation
- Graduated compression therapy
- Pharmacological management
- Sclerotherapy
- Surgical management

CONSERVATIVE TREATMENT[39]

Indications for conservative line of management are,

- Early stage of varicosity in young people
- Patient's refusal for surgery
- Patients who are unfit for surgery due to co-morbid condition
- Pregnant women
- Isolated perforator incompetence
- To relieve symptoms while waiting for surgery

Conservative line of management consists of

- Rest and elevation of the limb while on bed
- Compression with elastic stockings
- Exercises
- Weight reduction
- Avoidance of prolonged standing

ACTIVE TREATMENT

It may depend upon the size and site of varicose vein.

- For thread veins< 1mm diameter, laser treatment is recommended
- For reticular veins <4 mm diameter, sclerotherapy is useful.
- For vein of 4 to 10 mm diameter, phlebectomy using 2 to 3 mm stab incisions is treatment of choice
- For veins more than 10mm in diameter surgery and stripping are indicated.
- For saphenofemoral junction and saphenopopliteal junction reflux, suregery is the option.

COMPRESSION THERAPY

Since the time of Hippocrates, compression therapy in the treatment of varicose vein has been used. Compression therapy is used to improve venous return and lymphatic circulation.

MECHANISM OF ACTION

Graduated elastic compression is often the first line of treatment in varicose vein management. Compression has favourable effect on subcutaneous interstitial pressure. Increased interstitial pressure counter acts transcapillary starlings forces and promote fluid reabsorbtion and

resolution of edema with improved diffusion of nutrients to skin and subcutaneous tissue.

Intermittent pneumatic calf compression devices increases venous return and also enhance fibrinolytic activity in the blood. Graduated stockings are grouped into:

1. Standards

2. Material: Cotton, synthetic.

3. Length: Above knee, below knee.

4. Sizes: Small, medium, large, extra-large, custom sized.

Table 3: British standard

Class I	14 – 17 mm Hg
Class	17 – 24 mm Hg
Class	24 – 35 mm Hg

Table 4: International Standard (European)

Class I	20 – 30 mm Hg
Class	30 – 40 mm Hg
Class	40 – 50 mm Hg
Class	50 – 60 mm Hg

Table 5: Different Types of Compression

Types of Compression	Characteristics	Indications
Non-elastic Compression	Rigid compression garments or bandages with non-elastic property	Varicose vein Venous ulcers
Elastic Compression	Stockings or bandages (long or short stretch) made from woven textile with elastic properties	Varicose veins Post varicose vein surgery sclerotherapy
Compression systems	Multilayer bandages to sustain high compression for several days	Venous ulcers
Intermittent pneumatic Compression	Periodically inflated, pneumatic sleeves	Venous ulcers

- Recommended pressure in mild varicose vein, pregnancy, post varicose vein surgery- 20mm Hg
- In symptomatic varicose veins and after sclerothrepy – 30 mm Hg
- In venous ulcers and post phlebitic leg – 40 to 45mm Hg
- In phlebolymphoedma >45 mm Hg

COMPRESSION BANDAGES

Type I

Light weight confirming stretch bandages. These comprise light weight elastomer with high elasticity, but little power. These are used to retain dressings.

Type II (Short Stop)

These are light support bandages. They have minimal stretch. They exhibit limited elasticity but tend to lock out on minimal extension. In ambulant patient, CVI, they form an essentially inelastic covering to the leg which will exert pressure during calf systole but not during diastole. They are unsuitable for control of oedema

Type III (long stop) - These are extensible elastic and powerful to a varying degree.

Graduated compression has several effects on the venous system in the leg.

- Reduces venous wall tension
- Reduces venous reflux
- Decrease limb oedema
- Increase venous velocity
- Decreases venous volume
- Improve the symptoms associated with varicose veins
- Delays the progression of the changes of chronic venous insufficiency
- Reduce the risk of varicose vein recurrence

To be effective it must be strong (20-30mmhg at the ankle), graduated (maximal at ankle, reducing to 75% at the calf and 50% at the thigh) and replaced regularly (every 6 months).

INDICATIONS

Compression therapy is used for those limbs with deep venous reflex, or a combination of deep and superficial venous reflex, unsuitable for surgery.

CONTRAINDICATIONS

- Diminished arterial inflow (arterial pressure <70 mmHg).
- Severe congestive heart failure.
- Acute deep venous thrombosis.
- Undiagnosed ulcers (e.g., carcinoma cutis, leishmaniasis).

DISADVANTAGE

Non-compliance is a major problem. At least 10% of patients will not tolerate the use of stockings at all and further 25% will abandon the use of compression within a few months. This may be due to,

- discomfort or allergy
- inability to apply the stockings
- due to poor grip

- cost of replacement
- skin excoriation
- skin maceration
- dryness
- infection
- ulceration

PHARMACOLOGICAL MANGEMENT[40]

Phlebotropic drugs -majority of them are plant derived compounds. In those patients classified as having stage C0s disease, and in those classified as C1s and C2s for whom invasive therapy (sclerotherapy, surgery) does not appear warranted, phlebotropic drugs appear to be good first-line treatment of chronic venous disorder, possibly in conjunction with compression therapy.

At more advanced disease stages, phlebotropic drugs have no demonstrable additional benefit over compression on improvement of skin changes, or in ulcer healing

Classification of the phlebotropic drugs [41]

1. Benzopyrones

a) Alpha-benzopyrones Coumarins (1, 2-benzopyrones: 5, 6-alpha-benzopyrones) Dicoumarols (dimers of 4 hydroxycoumarins): oral anticoagulants.

b) Chromenones (flavonoids)

Micronized purified flavonoid fraction (MPFF) Diosmin, kacinprerol, diosmethin, quercetin, rutin and derivatives, O-(beta hydroxyethyl) rutosides (HR or oxerutins).

2. Saponins

Escin, horse-chestnut extracts, Extracts of ruscus, Centella asiatica

3. Other plant extracts

Anthocyanosides - blueberry extract (protoescigenin, barringtogenol, alpha and beta- escin, cryptoescin) Proanthocyanidols - grape seed extracts Ginkgo biloba

4. Synthetic products: Calcium dobesilate, Benzarone, naftazone

Pharmacological effects of phlebotropic drugs

1. Analgesic, antiedema and capillary protection effects.

2. Effect on venous tone

3. Lymphotropic effects

4. Improvement of red blood cell rheology

5. Profibrinolytic action

6. Anti-Inflammatory action

7. Decreased adhesive properties of neutrophils and monocytes

8. Protective effect on the venous valve

9. Protective effect on the venous wall

10. To relieve night time cramps- diosmin

SCLEROTHERAPY[48]

In 1845, Rynd developed sclerotherapy method of treatment.The aim of injection sclerotherapy is to inject a small quantity of sclerosant in the lumen of a vein empty of blood, and then oppose the walls of that vein with appropriate compression. The vein fibroses and gets closed without the formation of clot. The method is very effective for small and medium caliber veins (< 4 mm), in larger veins recurrence is frequent.

INDICATIONS

- Isolated below knee reticular varicosities.
- In the management of thread veins
- Immediate measure for a vein that has actually bled or threatens to bleed, because the covering skin is so thin.

- Recurrent varices
- In aged and infirm.
- In nonsurgical patients.
- Isolated incompetent perforating veins and their tributaries.
- Uncomplicated perforator incompetence

CONTRAINDICATIONS

- History of allergy or anaphylaxis
- Present or recent acute deep vein thrombosis
- When substantial or massive incompetence in a saphenous vein is present
- Should be done with care in pregnancy, immobile patient, person on contraceptive pill, obese patient, and elderly patient for fear of deep vein thrombosis.
- Presence of arterial disease or uncontrolled malignant tumor.

TREATMENT STRATEGY[49]

Treatment must be performed from below to upward direction and proceed from the largest to the smallest vein, it must be complete and must include short and long term follow up. Sclerosants used are

- Sodium tetra decyl sulphate (STDS)- commonly used
- Sodium morrhuate
- Ethanolamine oleate

- Polidocanol

The strength of sclerosant depends on the clinical circumstance, and the following is a rough guide for STD:

- Trunk: 1 - 3%
- Tributaries: 0.5 - 1%
- Reticular veins (<3mm): 0.2 - 0.5%
- Hyphenwebs (<1mm): 0.1 - 0.3%

MECHANISM OF ACTION

Injection of sclerosing agent results in an injury to the endothelium followed by sloughing and a transmural injury. The vessel reacts with spasm, inflammatory changes, acutely followed by chronic thickening and fibrosis leading to permanent occlusion of the varix. After injection of the sclerosant, the vein should be compressed to maintain the endothelial wall approximation.

TYPES OF SCLEROTHERAPY

- Microsclerotherapy
- Macrosclerotherapy
- Ultra sound guided sclerotherapy
- Foam sclerotherapy
- Transilluminated sclerotherapy

DISADVANTAGES

1. Excessive concentrations of sclerosant, if injected outside the vein will lead to the formation of deep and painful ulcer which will heal slow and leave a cosmetically unsightly mark on the leg.
2. Haematoma at the site of injection.
3. If the vein being injected is not empty or refills after injection, then a thrombophlebitis ensues leaving pain and a line discolouration along the vein, which is usually permanent.
4. Anaphylactic and Allergic reactions to the sclerosant.
5. Accidental intra-arterial injection (usually posterior tibial artery close to the medial malleolus).
6. Neurological problem either due to injection close to the head of the fibula or from over enthusiastic compression.
7. Prone to recurrence, and may require many visits and treatments over years.
8. Pigmentation.
9. Deep venous thrombosis.
10. Neoangiogenesis (telangiectatic matting) at the site of prior sclerotherapy.

FOAM SCLEROTHERAPY

Sclerosing foam is a number of gas bubbles in a liquid solution including surface-active molecules. The gas ought to well tolerate by patients, physiologic, and the bubble in size have to be, preferably, not more than 100 μ. Lorenzo Tessari's Tourbillon approach is the most frequently reported in the English literature.

Two plastic disposable syringes are interconnected by a three-way stopcock. The foam is made by mixing the liquid sclerosant with 4 or 5 parts of air, through 20 passes between the two syringes with the hub at a 30° rotation. This rotation narrows the stopcock passage providing high turbulence, which yields good-quality microfoam. Suitably, polidocanol, an alternate non-recognized detergent, is used in place of sodium tetradecyl sulphate. This is then plugged in onto an already accessed vein through the 3-way valve under Duplex USG control and not more than 20ml foam should be injected at one sitting.

The main concern is about injection of air into circulation and the risk of DVT. Air embolism is prevented by strictly restricting the amount injected at each sitting to 20ml, raising the leg during injection and monitoring with USG Doppler while injecting.

ADVANTAGES

- Easily available.
- Cheap.
- Easy to learn.
- Easy to perform.
- It is an outpatient procedure.
- Can be repeated many times.
- No anesthesia required.
- Can be used to treat the main saphenous trunks, unlike that of liquid sclerotherapy.

DISADVANTAGES

- Thrombophlebitis
- Pain over the injected vein.
- Pigmentation over the skin.
- Headache
- Transient blindness
- Stroke
- Air embolism

CONTRAINDICATIONS

- Deep vein thrombosis
- Peripheral arterial disease.

CATHETER DIRECTED SCLEROTHERAPY[42]

Doctors at the Miami Vein Clinic have devised special catheters for sclerosant injection to have a more controlled obliteration of the veins without the risk of systemic embolization.

The technique is limited by the lack of availability of various sizes of catheters. CDS has a better safety profile when compared with ultrasound-guided sclerotherapy, with virtually no risk of intra-arterial injection or sclerosant extravasations.

Compared with endovenous laser ablation (EVLA) and radiofrequency ablation (RFA), CDS is a less expensive and quicker method without tumescent local anesthesia and a power source.

MICROSCLEROTHERAPY

Very dilute solution of sclerosing agent like STDS (0.1% of 0.1 ml dilute) is injected into thread veins and reticular veins followed by application of compression bandage.

TRANSILLUMINATION MICROSCLEROTHERAPY (VEIN-LITE)

It is better imaging of the veins using light generated by halogen bulb with high quality fibre illumination over the skin uniformly and passing 30 gauge needles for microsclerotherapy.

SURGICAL TREATMENT

Numerous surgical procedures are designed to treat varicosities, including flush ligation, ligation and stripping, stab avulsion, perforator ligation, and others. Selection of the best procedure for each patient should be based on a preoperative evaluation of the anatomy involved. Up to 20% of varicose veins surgery worldwide, and that includes India, is done for recurrent disease.[50]

All patients planned for surgery should be informed regarding the risks and benefits of the intended procedure. The patient should be warned about the common, almost inevitable, consequences of surgery such as bruising and minor haemorrhage, thrombophlebitis, haematomas and wound problems, small areas of paraesthesia due damage to the sural and saphenous nerves, direct injuries to underlying structures like deep veins, arteries and major nerves, permanent lymphoedema and thromboembolism and the fact that it is some sometimes impossible to remove all prominent veins with stab avulsion technique. Any small residual veins can be dealt with by means of injection sclerotherapy, which should be viewed as an integral part of the overall treatment. The risk of recurrence, inevitable in a proportion of patients and the need for follow-up in studies must extend 5 - 10 years to assess the true incidence of recurrence.[50]

INDICATIONS FOR SURGERY

- Cosmosis
- Aching pain
- Leg discomfort
- Superficial thrombophlebitis
- Venous ulcer
- Lipodermatosclerosis
- Skin changes
- Bleeding
- Atrophie blanche

CONTRA INDICATIONS FOR SURGERY

Absolute contra indications

- Deep vein thrombosis
- Bleeding disorder
- Lymph oedema

Relative contra indications

- Infected venous ulcer
- Peripheral vascular disease
- Early symptomatic varicosities
- Early pregnancy
- Asympomatic varices in elderly

AIM OF SURGICAL MANAGEMENT

- Permanent removal of varicosities.
- Ablation of venous hypertension.
- To relieve symptoms.
- Achievement of best cosmetic result.
- Minimization of complications.

PATIENT PREPARATION

Pre-operative marking should be performed with an indelible marker pen. Routine antibiotic prophylaxis is given to patients undergoing surgery in CMCH setup.

HEPARIN PROPHYLAXIS

Patients with complicated veins or other known risk factors such as obesity, increasing age and poor mobility should receive heparin prophylaxis post operatively to prevent deep vein thrombosis. [43]

ANAESTHESIA

Varicose vein surgery can be performed under general, regional or local anaesthesia.

POSITIONING

Supine for great saphenous vein surgery, and prone or semi prone for short saphenous vein surgery. A head down position reduces venous

bleeding and the risk of air embolism but can lead to facial and laryngeal edema and ventilator problems.

PRINCIPLES OF SURGERY

- Ablation of the reflux from deep to superficial system.
- Removal/destruction of all varicosities existing at the time of surgical intervention.

SURGICAL PROCEDURES

- Ablative
- Reconstructive

Ablative:

For main trunk:

- Sapheno femoral junction flush ligation.
- Sapheno femoral junction flush ligation with stripping.
- Sapheno femoral junction flush ligation with sequential avulsion technique.
- Radio frequency ablation method (VNUS closure technique).
- Endo venous laser ablation therapy (EVLT).

For tributaries:

- Multiple stab avulsions.
- Hook phlebectomy.
- TRans Illuminated Vein EXtraction (TRIVEX).

For perforators:

- Sub fascial ligation (Cockett's and DODD's procedure).
- Vertical sub fascial ligation (Linton's procedure).
- Modified Linton's procedure.
- Minimally invasive methods
- Sub fascial endoscopic perforator surgery (SEPS)
- Radio frequency ablation
- Endovascular laser ablation
- TRIVEX method

SAPHENO FEMORAL JUNCTION FLUSH LIGATION: [44]

It is considered to be most essential part of any surgical treatment for varicose vein Involving great saphenous system which can be done under local anaesthesia. The patient is placed supine, with a degree of head down and the leg abducted. A skin crease incision of 5 to 8 cm in length beginning from sapheno-femoral junction (2.5cm below and lateral to pubic tubercle) and running parallel to the inguinal ligament is the preferred approach. The length of the incision should be adequate enough for proper exposure. Tissue forceps lifts the skin edges and the great saphenous vein identified and the fat over the vein is separated with wet gauze dissection till the main vessel is exposed. The terminal tributaries superficial external pudendal, superficial circumflex iliac and inferior

epigastric vein dissected out for a short distance from their termination, ligated twice for safety and divided. A number of anomalies can be present, the most common being a double saphenous vein, which normally receives large anterolateral thigh veins and posteromedial thigh veins.

The sapheno femoral junction is checked for any other tributaries, and then the great saphenous vein is ligated flush with the femoral vein, taking care not to damage the femoral vein. A transfixing ligature is then placed quarter inch distal to the first ligature. During ligation care must be taken not to tear the GSV, as the wall of the vein can be very thin. If stripping is not planned the wound is closed and tight bandage is applied. Patient is asked to keep the knee flexed and hip externally rotated to facilitate healing. Stripping of great saphenous vein:

Stripping markedly reduces the risk of recurrence by [45]

i) Avulsing the thigh perforators and saphenous tributaries and

ii) Preventing any neovascularisation arising from the saphenous stump reconnecting with the great saphenous vein.

Stipping can be done under local Anaesthesia[42]. The operation of Sapheno femoral flush ligation with stripping of the great saphenous vein is associated with improvement in the disease specific HRQOL (health related quality of life).[47] In the absence of deep venous reflux the surgery

eliminates reflux in 75% of incompetent perforator veins with a significant reduction in their mean numbers and diameter.

Stripping is performed only from groin to knee because of possiblity of damage to the saphenous nerve, if stripping is done below knee also. It is better to strip from above down as the reverse technique may result in the stripper being passed inadvertently into the deep venous system. The stripper consists of a wire or plastic 85-90 cm in length with an olivary tip at one end and acron- shaped head on the other.

TECHNIQUE

- Eversion
- Inversion

Eversion technique is associated with increased hematoma, saphenous nerve injury and increased post operative pain.

Inversion technique - Before proceeding to stripping the lower end of the wound is retracted and the posterior-medial thigh vein identified and ligated. After sapheno femoral ligation the distal end is temporarily controlled with a loosely tied ligature held in a haemostat. The great saphenous vein is now exposed through a small skin crease incision three fingerbreadths below the knee joint.

The stripper is introduced and is passed upward until it emerges through the upper end of the vein in the groin incision. A small acron is attached and the vein tied on to the stripper. The leg is ex-sanguinated and a pneumatic or bandage tourniquet applied around the upper calf. This provided bloodless field for operation.

The stripper is drawn a short distance upwards so that the acron head is drawn in through the incision. The vein is then divided below the ligature and the lower cut end is tied off. The groin and knee wounds are closed with absorbable subcuticular sutures leaving small opening for the stripper in the groin wound.

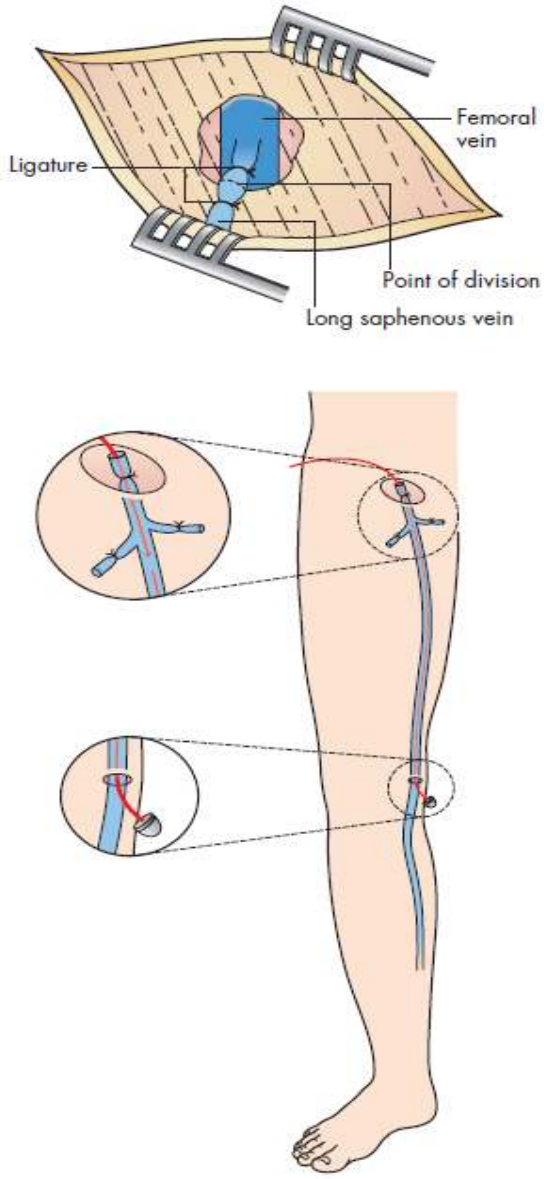


Figure 14: Stripping of great saphenous vein

Now an elastic bandage is applied from toes and gradually followed up, while the stripper is steadily pulled through the groin incision severing all the tributaries and perforating veins up to the groin incision. If stripper is stuck somewhere, the vein is freed and the vein distal to this incision is stripped. Again the olive point is introduced

through the vein here and pushed up. The stripper with the vein kept aside. The skin margins of groin incision are sutured and dressed.

SEQUENTIAL AVULSION TECHNIQUE

Following saphenofemoral junction flush ligation, the GSV is pulled taut in a cephalad direction. A forefinger is pushed down into the thigh posterior to the vein via the groin wound and a simple stab made just distal to the finger. The upper portion of the vein is then directed on to a hook or clip and delivered through the stab incision.

The GSV is again put on traction to render it taut in the thigh. It could be palpated about 10 cm distally. A further stab incision is made at this point and the upper portion of vein hooked out. This procedure is repeated sequentially down the thigh until the whole GSV is removed. Compression bandage is applied. It is argued that this procedure is less painful, reduces bruising and avoids a significant scar below the knee compared to stripping.

RADIO FREQUENCY ABLATION

Radio frequency ablation method (VNUS closure technique, VNUS Medical technologies, Inc, Sunnyvale CA,USA, by Goldman 2000) Performed under local anaesthesia and sedation. Percutaneous access to the GSV is obtained using duplex USG at the level of knee. A guide wire is passed till SFJ over which a closure catheter passed. The

prongs of the catheter are made to contact with the intima of the vein. The tip of the catheter and the prongs are made to attain 85 C temperatures with the help of a Radio frequency generator and the catheter is withdrawn slowly at the rate of 3cm/min. Collagen in the vein wall denatures and contract closing the lumen of the vein.

ADVANTAGES

- No incisions necessary. Return to normal activity next day.
- At 2 years after the procedure > 90% of saphenous vein remains closed which compare favorably with traditional procedures.
- This procedure offer advantages over the conventional stripping operation in terms of less post operative pain, short hospital stay, shorter sick leaves and faster return to normal activities.

DISADVANTAGE

Do not provide 'flush' occlusion of the saphenous vein, often leaving a tributary that requires surgery.

CONTRAINDICATIONS

1. Postphlebitic vein that cannot be accessed.

2. saphenous vein (>12mm).

3. Significant dilatation of the proximal saphenous vein with an aneurysmal SFJ.

SUB FASCIAL LIGATION OF PERFORATORS (Cockett's procedure)

Perforators are marked preoperatively by using duplex scan. Perforators are ligated deep to deep fascia through incision in anteromedial aspect of leg.

VERTICAL SUB FASCIAL LIGATION (Linton's procedure)

A long vertical incision made over the skin and perforators are ligated subfascially.

MODIFIED LINTON'S PROCEDURE:

A method of perforator vein interruption along with the removal of GSV & short saphenous vein and multiple sub fascial ligation, ulcer is excised and skin grafting done. Patients disability limited the wide spread acceptance of the procedure.

SUB FASCIAL ENDOSCOPIC PERFORATOR SURGERY (SEPS):

The recently developed technique of subfascial endoscopic perforator surgery has allowed perforating veins to be divided effectively with minimal morbidity through a small incision. SEPS is not indicated in primary uncomplicated veins but may have role in addition to saphenous ligation in patients with venous ulcers and who have no evidence of previous deep vein thrombosis.

Technique

Under spinal anaesthesia a short incision is made at the antero-medial border of the proximal third of the lower leg. After the fascia is horizontally incised, a mediastinoscope or endoscope 18 cm in length and 12 mm in diameter is inserted to examine subfascial region. All communicating veins are identified and ligated with hemoclips and dissected under direct vision. Previously, fasciotomy was done which is abandoned now.

SCORING SYSTEMS IN VENOUS DISEASE

The following scoring systems are used in venous disease to assess the severity of the disease and outcome of treatment.

- Venous Clinical Severity Score (VCSS)
- Venous Segmental Disease Score (VSDS)
- Venous Disability Score (VDS)
- Revised Venous Clinical Severity Score (RVCSS)
- Aberdeen Varicose Vein Questionnaire (AVVQ)
- Health Related Quality of Life Questionnaire (HRQOLQ)
- Short Form – 36 (SF-36)

METHODOLOGY

STUDY DESIGN

The study was carried out on 53 patients who were underwent varicose vein surgery in general surgery department in Coimbatore Medical College, with an objective to analyse the post operative outcome of varicose vein surgery.

- **Inclusion Criteria**

Patients with symptom and signs of varicose vein, admitted for varicose vein surgery.

  - Age group 15 years to 70 years

- **Exclusion Criteria**

  - Pregnant women patients
  - Elderly patients (age above 70 years)
  - Children (less than 15 years)
  - Patients with raised intra abdominal pressure
  - Patients with DVT
  - Patients with Congenital Venous Disease
  - Patients with secondary varicose vein

The study performed is a prospective, observational study. The study was conducted during the time frame of 12 months between September 2013 and August 2014.

TYPE OF SURGERY

The patients underwent the following types of surgery according to the clinical diagnosis.

- SFJ Flush Ligation only
- SFJ Flush Ligation +Perforator Ligation
- SFJ Flush Ligation + Stripping
- SFJ Flush Ligation + Stripping + Perforator Ligation

The patient's signs and symptoms were noted pre-operatively and arranged according to the frequency.

- Aching
- Skin changes/ eczema
- Ankle swelling
- Cosmetic
- Ulceration
- Phlebitis
- Bleeding
- Others

A detailed clinical history was taken for all the patients. Thorough physical examination was done for all the patients. Patients were evaluated preoperatively with following haematological tests:

- Haemoglobin percentage
- Leucocyte count
- Blood urea and Serum creatinine
- RBS, FBS
- Radiological and imaging studies, with contrast if indicated.

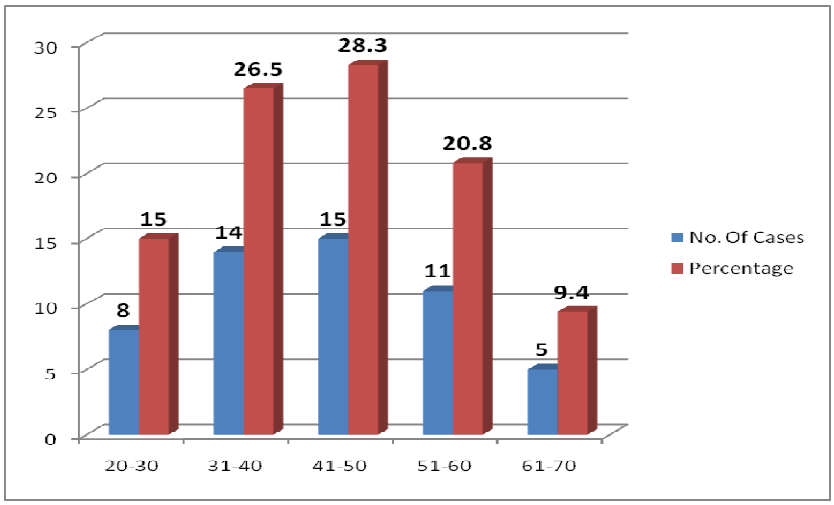
Patients were classified according to their CEAP class and followed up post operatively and observed for any complications.

RESULT ANALYSIS

The study of outcome of varicose vein surgery performed to 53 patients which is analysed in detailed manner and the observations are presented below.

AGE DISTRIBUTION

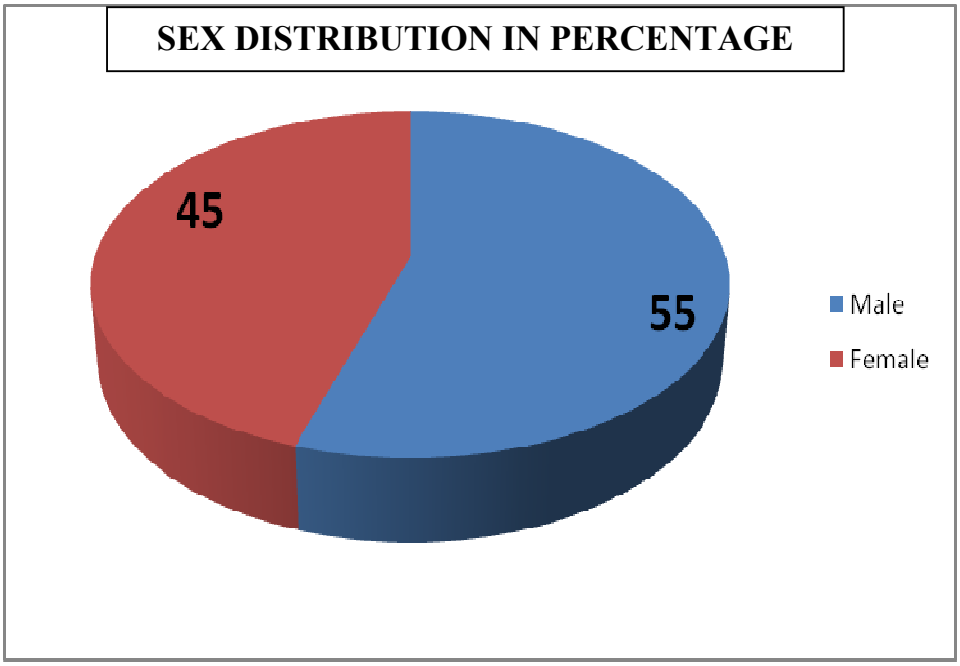
Age in years	No. of Cases	Percentage
20-30	8	15
31-40	14	26.5
41-50	15	28.3
51-60	11	20.8
61-70	5	9.4
Total	**53**	**100**



In age distribution, 29 patients (55%) belong to age group 31-50 years. Only 15% of cases belong to less than 30 years of age. Hence varicose vein is commonly present in age group 31-50 years in this study.

SEX DISTRIBUTION

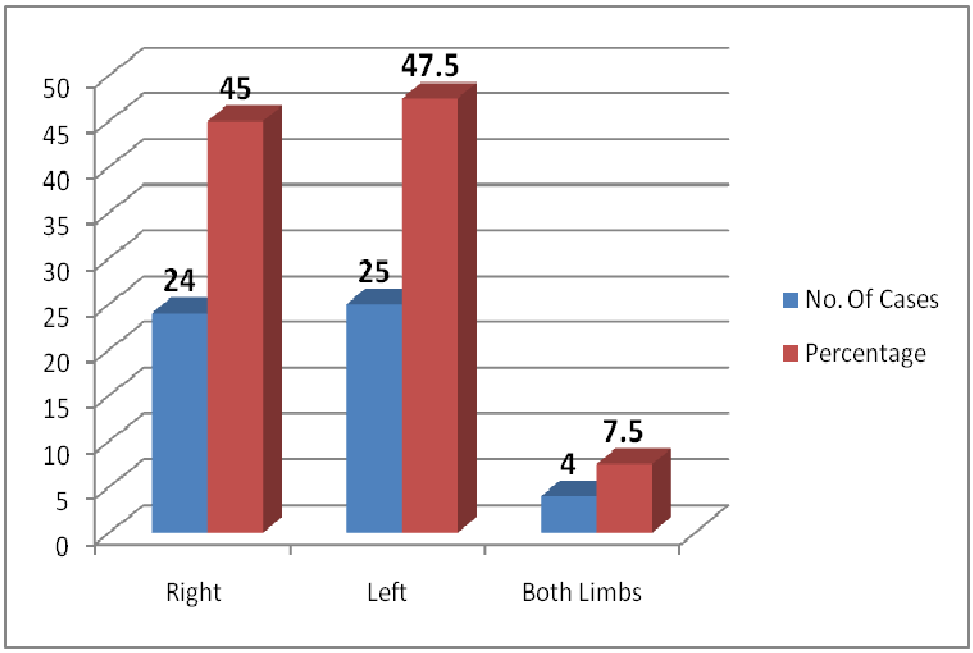
Sex	No. of Cases	Percentage
Male	29	55
Female	24	45
Total	**53**	**100**



It is observed that 29 male patients (55%) were affected and 24 female patients (45%) were affected.

SIDE AFFECTED

Side	No. of Cases	Percentage
Right	24	45
Left	25	47.5
Both Limbs	4	7.5
Total	**53**	**100**



There is no significant difference in side affected; in 4 cases both limbs were affected.

PRE-OP SYMPTOMATALOGY

Symptoms	No of cases	Percentage
Leg Pain	53	100
Cosmetic	53	100
Dermatitis	17	32
Pigmentation of skin	14	26.5
Ankle swelling	12	22.5
Ulceration non	14	26.5
Phlebitis	0	-
Bleeding	0	-

All 53 patients had leg pain, cosmetic problem. 17 patients had dermatitis and 14 patients suffered from leg ulcer.

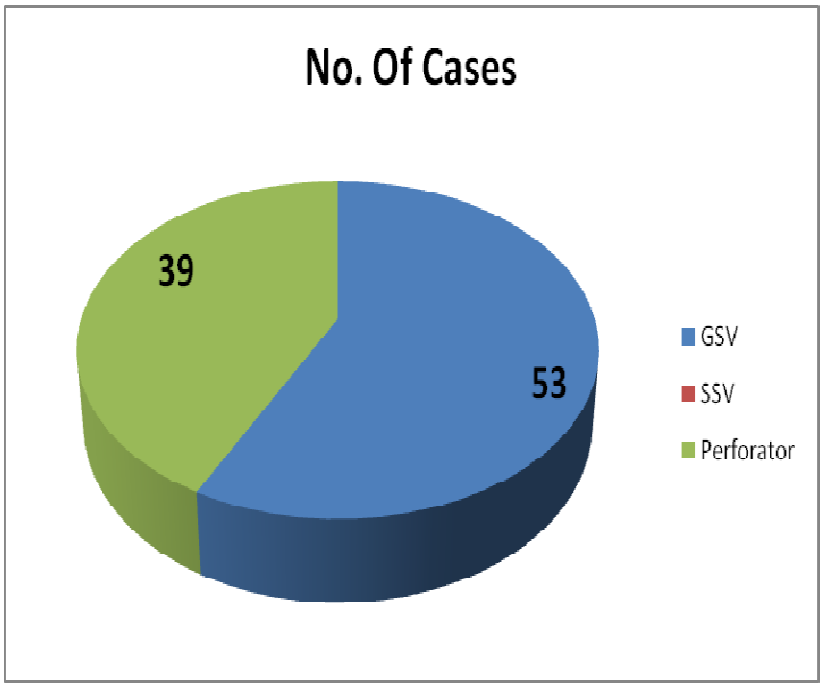
CEAP CLASS

Class	No. of Cases	Percentage
0	Nil	
1	Nil	
2	18	34
3	12	22.5
4	9	17
5	14	26.5
6	Nil	

It is observed that 18 patients (34%) belong to CEAP class 2 and 14 patients (26%) were belong to CEAP class5.

SYSTEM INVOLVED

System	No. of Cases
GSV	53
SSV	0
Perforator	39



GSV was involved in all cases and perforator incompetence was seen in 39 cases (73%).

SUGERY PERFORMED

Surgery Type	No. of Cases	Percentage
SFJ Flush Ligation only	10	19
SFJ Flush Ligation + Perforator Ligation	35	66
SFJ Flush Ligation + Stripping	2	3.75
SFJ Flush Ligation + Stripping + Perforator Ligation	6	11.25
Total	**53**	**100**

SFJ Flush Ligation + Perforator Ligation was done for 35 patients (66%).

COMPLICATIONS

Complications	No. of Cases	Percentage
Wound Infection	6	11.25
Bleeding	Nil	-
Seroma	9	17
Delayed Healing	Nil	-
Major vessel injury	Nil	-
Neurological problem	Nil	-
Deep vein thrombosis	Nil	-

Wound infection was seen in 6 cases (11%) and Seroma was seen in 9 cases (17%).

POST OP OUTCOME

Symptoms	Cured	Better	Same	Worse
Leg Pain	34	19	-	-
Pigmentation of	10	4	-	-
Dermatitis	17	-	-	-
Cosmetic appearance	24	29	-	-
Leg Swelling	7	4	1	-
Ulcer healing	8	4	2	-
Bleeding	-	-	-	-
Ability to do work	45	8	-	-
Overall QOL	42	11	-	-
Pleased with result of surgery	53	-	-	-

Overall quality of life was improved in all patients. 79% cases felt cured and 21% felt better after surgery. 34 patients felt leg pain was cured. Leg swelling was disappeared in 7 patients. Leg ulcer was cured in 8 patients. 45 patients were able to work well after surgery.

DUPLEX SCAN STUDY

Reflux	Present	Absent
SFJ Reflux	-	52
SPJ Reflux	-	53

All patients had competent SFJ and SPJ post operatively.

POST OPERATIVE PERFORATOR INCOMPETENCE

Post Operative Perforator Incompetence	No. of cases	Percentage
Single	12	22.5
Multiple	7	13.25
No-Incompetence	34	64.25

It is observed that perforator incompetence was present in 35% of cases.

DISCUSSION

In this prospective study a total number of 53 patients with primary varicose vein were admitted, investigated and operated. They were followed up regularly and the post operative results were analysed.

The study carried out with patient's age range from 20 to 70 years. Most of the patients are belong to 30 to 50 years age group. The male and female patient's ratio is 1.2:1. There is no significant difference in the left and right limb involvement.

In this study, all the patients had sapheno femoral junction incompetence. Sapheno popliteal junction incompetence not present in these patients. Perforator vein involvement is seen in 77% of patients.

The patients were followed in the post operative period for the expected complications and improvement in symptoms and sign. Out of 53 patients, 6 patients (11.25%) had mild wound infection which did not require any additional treatment. There was no incidence of deep vein thrombosis, pulmonary embolism. No patients experienced neurological deficit or paraesthesia in the post operative period. No patients experienced bleeding from wound. Leg pain was cured in 34 patients, leg ulcer was cured in 8 patients, cosmetic appearance was very much improved in 24 patients .45 patients were able to work well after surgery.

All the patients were subjected to duplex scan in the follow-up period ranging from 3 months to 1 year.

There is no evidence of recurrence of varicose vein on clinical examination. The duplex scan study reveals that competent sapheno popliteal junction in all patients, competent Sapheno femoral junction in all patients. Perforator vein incompetence was seen in 19 patients (36%).

CONCLUSION

This work was carried out successfully which was aimed at studying the outcome of the patients who have undergone varicose vein surgery in CMCH during the period of September 2013 - August 2014. The patients were followed in the post operative period for the expected complications and symptoms and sign improvement. All the patients were subjected to duplex scan in the follow-up period ranging from 3 months to 1 year.

To conclude, patients with complications of varicose vein combined with valvular incompetence underwent surgery like saphenofemoral junction flush ligation, with/ without stripping; with/without perforator ligation have had improvement in their life style as well as recurrence of varicose vein was not seen in our study group. Most of patients had improvement in cosmetic appearance, cure in leg pain and leg ulcer healed. The study period was very short, so patients need long term follow-up to find out recurrence. Duplex scan study revealed new perforator occurrence in some of patients. These patients require life style modifications and use of elastic stockings for longer period. These patients also need long term follow up to study any other problem.

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PROFORMA

Name: DOA:

Age/ Sex: DOS:

Occupation: DOD:

Address:

CHIEF COMPLAINTS:

1. Leg Pain
2. Itching and skin discolouration
3. Leg ulcer

PAST HISTORY:

1. H/O DM/ HTN/ Asthma/ TB/ Epilepsy
2. H/O previous surgery

PERSONAL HISTORY:

Smoker / Alcoholic.

GENERAL PHYSICAL EXAMINATION:

1. Hydration
2. Nutritional status
3. Pallor
4. Icterus
5. Cyanosis/ clubbing/ edema
6. Generalized/ regional lymphadenopathy
7. Pulse rate

8. Blood pressure.

SYSTEMIC EXAMINATION:

- PER ABDOMEN:

  Inspection.

  Palpation.

  Percussion.

Auscultation- bowel sounds.

- RESPIRATORY SYSTEM:

  Inspection

  Percussion

  Auscultation

- CARDIOVASCULAR SYSTEM:

  Inspection

  Auscultation

- CENTRAL NERVOUS SYSTEM:

  Consciousness

  Orientation

  Higher mental functions.

- EXAMINATION OF VARICOSE VEIN

DIAGNOSIS:

SAFETY CONSIDERATIONS:

The safety of the patients will be foremost. The procedures of taking blood samples will be under aseptic conditions using necessary precautions. Patients will be exposed to X-ray only for the purpose of taking chest X-ray and abdomen X-ray which is necessary for diagnosis and treatment. All procedures done, both operative and non-operative will be done after the due consent of the patient or his/her attendant.

CONSENT FORM

It has been explained to me in my mother tongue and I completely understand my condition, its related complications and the treatment options available. I have been explained in detail regarding this study- **"STUDY OF POST OPERATIVE OUTCOME OF VARICOSE VEIN SURGERY".** I hereby give my consent to participate in the above mentioned study.

DATE:

PLACE:

SIGNATURE OF THE RELATIVE WITH NAME

SIGNATURE OF THE PATIENT WITH NAME

SIGNATURE OF THE WITNESS WITH NAME

QUESTIONNAIRE

1. Leg Pain
☐Cured ☐ Much better ☐ Same ☐Worse

2. Pigmentation of skin
☐Cured ☐ Much better ☐ Same ☐Worse

3. Dermatitis and Eczema
☐Cured ☐ Much better ☐ Same ☐Worse

4. Cosmetic appearance
☐ Excellent ☐ Good ☐ Same ☐Worse

5. Leg swelling
☐Cured ☐ Much better ☐ Same ☐Worse

6. Ulcer healing
☐Cured ☐ Much better ☐ Same ☐Worse

7. Bleeding
☐Cured ☐ Much better ☐ Same ☐Worse

8. ability to do work
☐ Excellent ☐ Good ☐ Same ☐Worse

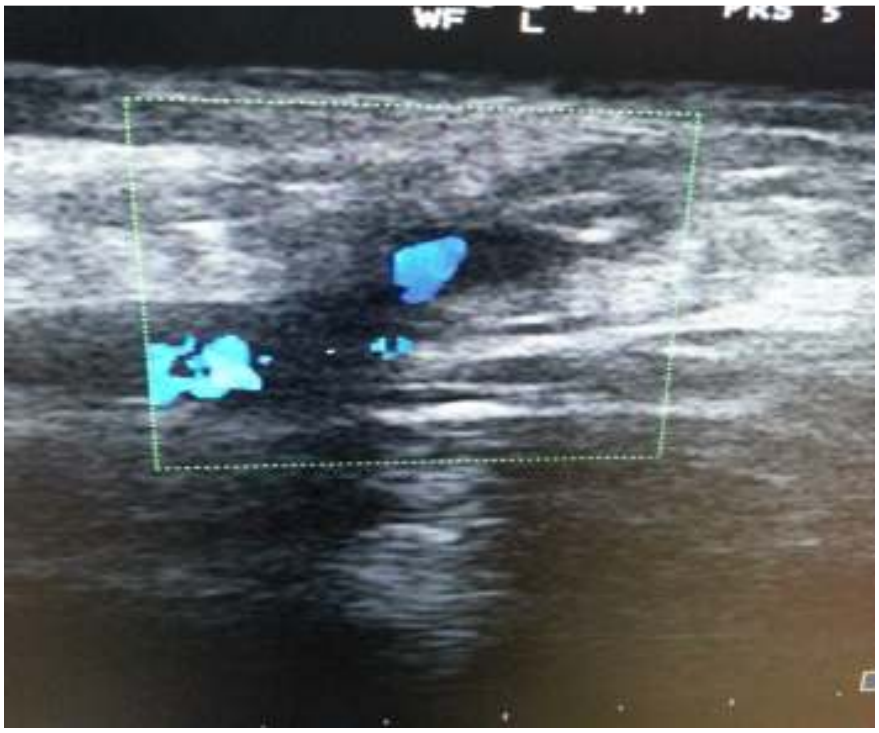
9. Overall quality of life
☐ Excellent ☐ Good ☐ Same ☐Worse

10. Are you pleased with the result of your surgery?
☐Yes ☐ No

PHOTOS

POST OP DUPLEX SCAN

ABSENT GSV



IMMEDIATE POST OP

VARICOSE VEIN CEAP CLASS 5

PERFORATOR

SAPHENO FEMORAL JUNCTION

1 YEAR AFTER SURGERY

MASTER CHART

S. No	Name of the Patient	Sex	Age	IP	System involved	Type of Surgery			SSG	Post op Doppler Study				Quality of Life	
						SFJFL	PL	Stripping		SFJ Reflux	SPJ Reflux	Perforator Incompetence		Cured	Better
												Single	Multiple		
1	KARUPPASAMY	M	35	78230	Lt. VV	Yes				No	No			Yes	
2	MATHIARASAN	M	22	36741	Lt. VV	Yes	Yes			No	No				yes
3	RAMRAJ	M	69	8430	Lt. VV	Yes				No	No			Yes	
4	RAMESH	M	34	38688	Lt. VV	Yes				No	No	yes		Yes	
5	BALAKRISHNAN	M	38	56270	Lt. VV		Yes			No	No				yes
6	RAMASAMY	M	55	512	Lt. VV	Yes	Yes			No	No			Yes	
7	RANGASAMY	M	30	2196	Lt. VV	Yes	Yes			No	No			Yes	
8	GOVINDARAJ	M	41	76248	Lt. VV	Yes	Yes			No	No			Yes	
9	SANKAR	M	21	3485	Lt. VV	Yes	Yes	yes		No	No			Yes	
10	GOPAL	M	50	20414	Lt. VV	Yes				No	No			Yes	
11	RAMESH	M	46	24970	Lt. VV	Yes	Yes			No	No	yes		Yes	
12	NEELAVENI	F	37	6458	Lt. VV	Yes		yes		No	No		Yes	Yes	
13	VALLIAMMAL	F	60	3777	Lt. VV	Yes	Yes		yes	No	No				yes
14	DEVI	F	25	48961	Lt. VV	Yes	Yes			No	No		Yes	Yes	
15	AMIRTHAM	F	53	66801	Lt. VV	Yes	Yes			No	No			Yes	
16	LAXMI	F	60	6244	Lt. VV	Yes		yes		No	No	yes		Yes	
17	SUBBU LAXMI	F	35	46876	Lt. VV	Yes	Yes			No	No			Yes	
18	GOVINDAMMAL	F	62	31289	Lt. VV	Yes				No	No		yes	Yes	
19	YESODHA	F	42	687	Lt. VV	Yes				No	No	yes		Yes	
20	KALAISELVI	F	37	6531	Lt. VV	Yes	Yes	yes		No	No	yes		Yes	
21	MAHESWARI	F	28	46134	Lt. VV	Yes	Yes			No	No			Yes	

22	MARY	F	48	27949	Lt. VV	Yes	Yes			No	No		yes		yes
23	SIVAGAMI	F	40	37845	Lt. VV	Yes	Yes			No	No			Yes	
24	MAHESWARI	F	37	14333	Lt. VV	Yes				No	No	yes		Yes	
25	SELVI	F	30	6049	Rt. VV	Yes				No	No			Yes	
26	MERCY	F	40	2042	Rt. VV	Yes	Yes			No	No		Yes		yes
27	SIVABACKIAM	F	60	44196	Rt. VV	Yes				No	No	yes		Yes	
28	JEMIRA BANU	F	45	55079	Rt. VV	Yes	Yes	yes		No	No			Yes	
29	SAJINA BANU	F	36	63392	Rt. VV	Yes	Yes			No	No			Yes	
30	PACKIALAXMI	F	45	23045	Rt. VV	Yes	Yes			No	No			Yes	
31	PUSHPA	F	40	69631	Rt. VV	Yes	Yes	yes		No	No	yes		Yes	
32	BALASUBRAMANI	M	55	46416	Rt. VV	Yes	Yes			No	No	yes			yes
33	SUKUMARAN	M	54	40171	Rt. VV	Yes	Yes			No	No				yes
34	RAMU	M	68	37180	Rt. VV	Yes	Yes			No	No		Yes	Yes	
35	NATHAN	M	25	29105	Rt. VV	Yes	Yes			No	No	yes		Yes	
36	PALANISAMY	M	48	27582	Rt. VV	Yes	Yes			No	No			Yes	
37	SUBRAMANI	M	52	895	Rt. VV	Yes	Yes	yes		No	No				yes
38	ANBAZHAGAN	M	42	8487	Rt. VV	Yes	Yes			No	No			Yes	
39	THANGAVEL	M	45	23030	Rt. VV	Yes	Yes	yes		No	No	yes		Yes	
40	RAJENDRAN	M	50	77054	Rt. VV	Yes	Yes			yes	No		Yes		yes
41	VINAYAGA MOORTHY	M	43	42981	Rt. VV	Yes				No	No			Yes	
42	JAYA PRAKASH	M	68	1664	Rt. VV	Yes	Yes			No	No				yes
43	VEERAN	M	62	72	Lt. VV	Yes	Yes			No	No			Yes	
44	RAMRAJ	M	55	45765	Rt. VV	Yes	Yes			No	No			Yes	
45	VENKATESH	M	50	27489	Rt. VV	Yes	Yes			No	No			Yes	
46	HIMACHALAM	M	46	24985	Rt. VV	Yes	Yes			No	No	yes		Yes	
47	HALITH	M	35	21243	Rt. VV	Yes	Yes			No	No			Yes	

48	MADHAN	M	54	73761	Rt. VV	Yes	Yes			No	No			Yes	
49	SIVA KUMAR	M	39	67234	Rt. VV	Yes	Yes			No	No			Yes	
50	SAROJINI	F	45	30071	Rt. VV	Yes	Yes			No	No				yes
51	KAVITHA	F	27	28592	Rt. VV	Yes	Yes			No	No			Yes	
52	KANNAMMAL	F	56	40874	Rt. VV	Yes				No	No			Yes	
53	JACQULINE	F	35	34505	Rt. VV	Yes	Yes			No	No			Yes	